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EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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CONTENTS

The centralization of the management of the operating departments of four Vanderbilt roads, announced in our news columns last week, indicates that the partial centralization that has existed for two years past has proved satisfactory. Putting the management of the operating departments of both the New York Central and the Lake Shore in the hands of President Newman and Vice-President Brown must have proved effective in simplifying the work, else the directors would not now give these apparently overworked men two other large roads to look after. It is reasonable to suppose that such simplification has taken place and that further progress in that direction can now be accomplished. Important questions constantly coming up, such as distribution of cars, standardizing and economizing in maintenance and repairs, and concerning purchases of all kinds must demand frequent conferences between the officers of these four roads. The ownership of the four being so nearly unified the officers are bound to consult with each other as a simple duty to the properties. But with the wisest heads and the most conciliatory dispositions they must often have difficulty in reaching decisions promptly; and so it may well be that a president or a vice-president who has authority arbitrarily and summarily to settle the differences of general managers and local officers will save much time for all concerned. This happy result is by no means dependent on infallible or all-powerful men for presidents and vice-presidents. The theory that by paying salaries of triple size it is possible to get railroad managers who will accomplish 24 hours' work in a day is unsound to start with; and is not necessary in any event. Men who work eight hours a day can accomplish as much; for it is not the quantity but the quality or kind of work that counts. It is not to be supposed that these New York Central men with four titles will make fewer mistakes than before, except as their efficiency is increased by relief from unnecessary negotiation and by added experience; the centralization is theoretically justifiable regardless of this consideration. Moreover the perfection and cheapening of long distance telephone lines makes centralization possible now in many matters where it was impossible, or much more difficult, a few years ago. The possibility imposes the duty. The traffic departments west of Buffalo are centralized but are left separate from the traffic department east of Buffalo. This appears to be due mainly to the fact that the time-honored dividing line between Trunk Line territory and Central Traffic Association territory, still exists, and rightfully exists. There simply is no present need of any more perfect union between east and west. In the case of the treasury and accounting departments it may be said that there was no reason why they should not have been centralized long ago. The New York, Chicago & St. Louis appears to have been left out of the new arrangement because that line is allowed to consort with the Lackawanna and the Lehigh Valley about as it pleases. In the old days it would have been said that it was a "free lance"—the Lake Shore's weapon for guerilla warfare. But the past few years' freedom from rate disturbances pretty clearly shows that the Vanderbilt lines' policy toward competitors is conservative. Mr. Canniff, of the N. Y., C. & St. L., seems to be in the happy position of a president whose stockholders never even think of questioning his policies.

According to recent advices, the Pennsylvania estimates that the number of St. Louis tickets sold during the Fair in the territory east of Pittsburg and Erie on its lines was only 39,358, as compared with 118,738 tickets sold for the Chicago Fair in 1893, and 3,793,455 tickets sold for the Centennial Exhibition in 1876. Of course, the fact that the 1876 Centennial was held in Philadelphia gave the Pennsylvania a strategic position of the greatest importance, but it nevertheless seems quite clear that there was far less public interest in this last great exhibition than in either of the other two. It was pointed out in the *Railroad Gazette*, June 3, 1904, that in spite of the fact that the total passenger earnings of the country were less in 1876 than in 1875, owing to a period of business depression, the Pennsylvania lines east of Pittsburg gained 54½ per cent. in passenger earnings; the Philadelphia, Wilmington & Baltimore gained 35 per cent.; the Pittsburg, Cincinnati & St. Louis, 20 per cent.; the Pittsburg, Fort Wayne & Chicago, 9½ per cent., and the Baltimore & Ohio, 10¼ per cent. The general effect of these great expositions on passenger traffic is hard to calculate in this country, owing to the singular fact that the Centennial, the Chicago Exposition, and the St. Louis Exposition each came in an off year. In 1876 there was sharp business depression, although the period did not culminate until the year following; 1893 was a very bad year indeed, and 1904, particularly in the earlier months, showed a marked setback from the three or four years preceding, although it could scarcely be designated as a year of depression. The results from the railroads concerned most directly with the St. Louis Fair traffic, such as the Wabash, will be awaited with great interest, and will undoubtedly show a very pretty profit, in spite of the fact that enthusiasm for great national or international fairs is certainly much less in this country than it was 28 years ago.

The new president of the Long Island Railroad must be accounted a man of remarkable bravery. He has made an advance in passenger fares, where he has hundreds or thousands of "commuters" to denounce him as an oppressor; and these complainers have a sympathetic legislature to run to. In all the advances in prices of the past three years we do not recall an increase of any consequence in passenger rates, though the cost of passenger service has increased with that of everything else. It is true that, as Mr. Potter has said, this increase in fares has been under consideration for many months (before President Baldwin was incapacitated); it is also true that the increase applies almost wholly to two branches on which the rates were decidedly lower than on other parts of the company's lines; but the general impression will be that all the suburban towns on the Island are to suffer, and many persons will be likely to attribute the move to the fact that there is a new management. Hence, as we say, the act must be called a bold one. But what else could have been done? As was shown in the company's re-

port (*Railroad Gazette* Dec. 9, page 611) the increase in expenses of the past two years has more than eaten up the profits of the business of the company. The suburban traffic and the summer excursion business constitute the company's only sources of profit. Other roads centering in New York have through passengers and a large volume of freight—the Long Island has neither of these. For eight months in the year its passenger business is conducted at a loss, which must be made up in the summer. Before competent and impartial judges it would be easy, probably, for the New York Central or the New Haven to show that their suburban passenger business at present rates is done at a loss,* except as it helps their through business and their freight; and the Long Island has neither of these to need help.

The first argument which will be brought against the Long Island in the Legislature will be, no doubt, that the way to increase profits is to enlarge the volume of business; but the Long Island is in the peculiar situation of having begun a process of this kind for the completion of which several years will be required. When it has finished its tunnel to Manhattan and has abolished all its grade crossings it can increase its speed and its accommodations sufficiently, no doubt, to attract enough passengers to make a good profit at low fares; but how much can it afford to lose meantime? It has made some pretty expensive temporary improvements already—such as the elaborate terminal interlocking at Long Island City, which will be largely unserviceable when the tunnel is put in use. With its present cars, engines, terminals and facilities it must, for many of its passengers, run 20 or 30 train miles to carry the people only two or three miles; and it is plain that there must be a limit somewhere to that kind of economy. There is one direction in which the company can improve its service without regard to the tunnel improvement—run more frequent ferry-boats to and from Manhattan; and this improvement it is now preparing for. The ferries will probably be profitable even when the tunnel takes all the passengers that desire to go through it. It is impossible to say in advance whether President Potter has or has not taken the wisest means of meeting his greatly increased expenses—whether he has assessed the burden on the right section of his traffic; but if it is quite certain that traffic experts will agree that he was bound to do something; and, on the whole, they will probably decide that there was nothing else that he could do. But if it comes to a fight in the Legislature against a rate-reducing law, there will be another kind of experts to deal with.

FOUR-CYLINDER BALANCED COMPOUND LOCOMOTIVES.

In a little over three years the number of four-cylinder balanced compound locomotives in use in this country has increased from one to about 100, and before the end of the year there will probably be nearly 200 in service. These figures give unmistakable evidence that, at last, the four-cylinder balanced principle is to be given a thorough trial in this country. In 1901 the Baldwin Locomotive Works built a ten-wheel four-cylinder balanced compound for the Plant System, but this engine was finally sold to the Chicago Short Line. Since then the Santa Fe and the Burlington have experimented with this type of engine, and as a result both roads have bought a number of Atlantic type balanced compounds. The Santa Fe alone owns about 60. The New York, New Haven & Hartford has recently received the first of a lot of 22 from the Baldwin Locomotive Works, and the New York Central has for some time been experimenting with a Cole four-cylinder balanced compound built by the American Locomotive Company. The Pennsylvania last year bought in France an Atlantic type de Glehn balanced compound, which has been given a pretty thorough trial in service. Without a single exception, so far as we have been able to find out, the four-cylinder balanced compounds have been satisfactory. The de Glehn has developed several defects in the design of the driving boxes, but these can be easily modified to meet the requirements of our service and practice. The engine is now being overhauled.

Comparative tests made by the Burlington and Santa Fe show marked economies in favor of the balanced compound in fuel consumption and in time-making ability. The engines ride smoothly and accelerate the trains rapidly, and have a larger reserve of power than simple two-cylinder engines of the same size and weight. In general, the four-cylinder balanced compounds used about 20 per cent. less water per indicated horse power per hour than the simple engine working under similar conditions of speed and load. A somewhat larger saving in coal should be expected owing to the fact that as the rate of evaporation decreases, the efficiency of the boiler increases. It therefore seems reasonable to expect that, if four-cylinder balanced compounds are used in place of two-cylinder simple engines the wear and tear on the boiler, and hence the cost of boiler repairs, would be materially decreased.

The almost perfect balance which is obtained with the four-cylinder arrangement will certainly tend to greatly diminish the cost of track maintenance and repairs, and this item alone is of sufficient magnitude to warrant a thorough investigation of the merits of the balanced locomotive. Although the static axle loads in present practice seldom exceed 50,000 lbs., it is well known that at high speeds the effect of horizontal overbalance or imperfect counterbalancing may be to increase the static loads by over 50 per cent. In another column a photograph is shown of rails in a track which have been bent and twisted by a poorly balanced locomotive running at high speed. This, of course, is an extreme case. Rails are not always bent by a locomotive, but at every revolution of the driving wheels a severe blow is dealt the track which tears up the ballast and tends to throw the track out of alinement.

One of the strongest criticisms against the four-cylinder balanced compound has been prompted by the use of a cranked axle, which is a necessary feature of its design. In the light of more recent experience it appears, however, that the cranked axle in combination with the four-cylinder arrangement is an element of strength and reliability rather than of weakness. Each crank of a four-cylinder balanced locomotive is subjected to only about one-half the strain imposed upon a crank of a simple two-cylinder engine of the same weight and power. The power is divided between four sets of cylinders, crossheads, rods, etc., instead of between two sets, as in the simple engine, and hence, the weight and strength of the main rods and several other details of a balanced compound can be made less than similar parts of a two-cylinder locomotive. American designers have not, as yet, taken full advantage of this, but European designers, notably the Germans use lighter main rods on four-cylinder balanced compounds than on two-cylinder engines.

Representative Esch, of Wisconsin, has introduced in the lower house of Congress a bill, No. 18,469, to require the gradual introduction of the block system on railroads engaged in interstate commerce. This bill is substantially the same as that which was laid before Congress by the Interstate Commerce Commission a year ago, and published at that time in the *Railroad Gazette* (Jan. 1, 1904, page 14), except that a section has been added prescribing a penalty of $1,000 a day for failure to comply with the law. Congressman Esch recently wrote a magazine article on the subject of railroad accidents (*North American Review*, November), and as he there made an intelligent study of the causes of collisions he may be expected to take more than a perfunctory interest in the subject of prevention, as embraced in his bill. He called also for a law to forbid excessive hours in railroad work; but this subject is not touched upon in the bill which he now presents. One of the most palpable dangers from excessive hours is that due to the custom of allowing night and day signalmen to work for each other in emergencies. This, however, is hard to deal with by legislation, for a law must make some allowance for emergencies; and it may well be that Mr. Esch omits this subject from his bill because of the difficulty of framing a satisfactory statute. But however great may be the difficulties which the subject presents in Congress, the superintendent who is on the ground need have no difficulty in formulating proper rules concerning it. He may have some difficulty in enforcing his rules, but he is bound to show that he has made his best endeavors. On a trunk line not far from New York a signalman was recently on duty 36 hours without relief. The superintendent who allowed that should read the last Government Accident Bulletin, which tells of a collision (No. 2) caused by a signalman going to sleep with his signal in the all-clear position. In view of such instances as these it will not be strange if Mr. Esch and other congressmen advocate laws to regulate the details of railroad operation.

Returns from the Pennsylvania for the entire year 1904 are now at hand, although they are expressed only in the form of increases or decreases from the results of the year previous. The lines directly operated by the Pennsylvania Railroad report a decrease of $4,481,200 in gross, a decrease of $2,970,100 in operating expenses, and a decrease of $1,511,100 in net earnings. This showing is materially aided by the results from the month of December, when gross earnings increased $869,500 and net earnings increased $383,600. The lines west of Pittsburg and Erie directly operated make much the best showing. Gross earnings for the

*The increased rates on the Long Island were incorrectly stated last week. The rate of $9.33 monthly for 14.7 miles should be $6.81, which is the average for 12 months: the higher rate is for the first month of the year. The rate of $6.81 is about 25 per cent. higher than the rate for a similar distance on a number of other roads centering in New York.

year ending December 31 decreased only $743,900 as compared with the results in 1903, while expenses were cut down $1,990,600, leaving an increase in net earnings of $1,246,700. The record for December was likewise particularly good, with an increase in net of $656,200, more than half of the increase for the entire year. Of the three other companies reported on the sheet as parts of the system, the Philadelphia, Baltimore & Washington shows a decrease in gross for the year of $46,300, an increase in expenses of $174,900 and a consequent decrease in net earnings of $217,200. This is undoubtedly partially due to a heavy charge for maintenance of way. Much of the construction work on the Pennsylvania system was stopped last spring to permit of retrenchment, but the P., B. & W. betterments were continued. The other two companies, the Northern Central and the West Jersey & Seashore, both show increases in net earnings as a result of the year's operation. On the Northern Central an increase of $122,700 net was made contemporaneously with a decrease of $21,900 in gross. On the West Jersey & Seashore gross increased $41,100 and net increased $103,600.

The Santa Fe is contemplating an experiment in New Mexico, Arizona and California to protect its tracks from drifting sand. The loose, sandy slopes of cuts and the land beyond, to the limit of the right of way, are to be covered with vegetation, to hold the sand during wind storms. This has been done successfully in southern Europe, but the difficulty arises in finding plants that will meet the peculiar conditions. The list of plants that will thrive in a country where the heat and wind are excessive, the rainfall quite small and its distribution uneven, is necessarily quite limited, but it is believed that the following can be depended upon: *Lippia repene*, a perennial creeping plant, grows rapidly in the poorest soil and soon covers the ground in a dense mat. *Capriola Dactylon*, Bermuda grass, is another creeping perennial, which covers the ground rapidly and, like the former, binds it well by rooting at every point. These two plants have been tested in the sandy plain of the southwest. They have been used for lawns, depending entirely upon the rains for moisture and here have even stood the tramping and hard usage of a tennis court, which proves that they are hard to kill. *Ailanthus glandulosa*, Tree of Heaven, might under certain circumstances be used by keeping it in shrub form. It is of easy growth and as it suckers quite freely, it would not be necessary to plant it close. The young shoots are soft and can be kept low by mowing. Several species of *Robinia* and *Aralia* also thrive in the dry plains, but as they are all thorny or spiny, they are not very desirable. *Bromus enermis*, Awnless Brome grass, is an upright growing perennial, which is used for holding sandy banks and slopes along the Atlantic coast and in Europe. It penetrates the ground to a depth of several feet and makes a perfect sheet of matted roots. Being a grass feeder it is likely to succeed in higher altitudes.

Senator Lodge, of Massachusetts, has introduced in Congress a bill "to promote the security of travel upon railroads and to encourage the saving of life," which empowers the President to give bronze medals to persons who by extreme daring endanger their own lives, in saving or endeavoring to save lives, etc., upon any railroad engaged in interstate commerce. In addition to the medal a rosette or knot is to be provided to be worn in lieu of the medal; also, a ribbon to be worn with the medal; and if a ribbon is lost or destroyed a new one may be issued in its place. This bill is patterned after the law of 1874 under which the Secretary of the Treasury gives gold and silver medals to heroes on the sea and in the life-saving service. As the proposition is in line with the practice of many of the railroads on which Brown's discipline is in force, of awarding "merits" for conspicuous acts of bravery or heroism, and publishing the facts in bulletins, the bill will probably meet the approval of railroad men, at least in theory Whether or not it will be fair and satisfactory in operation is another question. It is one more effort to have the Government take a hand in everything, from a transit of Venus in the South Sea Islands to whipping posts in Anacostia. The trouble with the "heroism" feature of Brown's discipline is that cases which can be dealt with by the superintendent under the rules occur so rarely that he does not give much thought to the matter. No doubt, much heroism goes undiscovered. In the case of a medal from the President of the United States, however, it is quite possible that rarity may be a good thing; the rarer the reward the greater its value. But why should a railroad man have a bronze medal, when the sea-coast life savers have gold or silver?

NEW PUBLICATIONS.

Poor's Railroad Manual Appendix, 1905. A Directory of Railroad Officials published by Poor's Railroad Manual Company, 68 William street, New York.

As the name indicates, the directory at hand contains a full list of the officers of both steam and electric railroads throughout the United States. It is well indexed and forms a useful addition to Poor's Railroad Manual.

TRADE CATALOGUES.

Steam Turbines.—The Westinghouse Machine Company, East Pittsburg, Pa., sends a catalogue descriptive of the Westinghouse-Parsons steam turbine. The pamphlet opens with an interesting but brief article on the origin and development of steam turbines. This is followed by a general description and detailed illustration of the present Westinghouse-Parsons machine. The data sheets in the back of the pamphlet show the results of efficiency tests on the 400 k.w., 750 k.w. and the 1,250 k.w. turbines. Half-tone illustrations showing 12 recent important installations of turbines made by the company are also given.

Paints.—The National Paint Works, New York, sends a pamphlet bearing the title "Technical Paints." The merits of the various paints made by this company for use on gas holders, power plants and water towers are set forth, and the number of square feet that each grade of paint will cover is given. Some interesting results of tests obtained by the Niagara Falls Power Company with paints for the protection of iron and steel are also given.

Rock and Ore Breakers.—The Allis-Chalmers Co., Milwaukee, Wis., sends a copy of its publication No. 117, entitled "Gates Rock and Ore Breakers, Styles D and F." Full detailed descriptions of these machines are given and a half-tone sectional view of the type D breaker clearly shows its general construction. The type F machine is smaller than the type D machine, and has been especially designed for work in laboratories.

The Union Switch & Signal Company.—Bulletin No. 23, just issued, is devoted to the Electric train staff, which was described in the *Railroad Gazette* of Dec. 23, 1904. Full-page illustrations of the apparatus are shown, together with an account of the permissive feature and the pusher engine attachment; also Mr. C. A. Goodnow's account of the use of the train staff on the Savanna bridge of the Chicago, Milwaukee & St. Paul.

Electrical Catechism.—The National Electric Co., Milwaukee, Wis., has begun a somewhat novel scheme for giving information of the principles and practice of electrical engineering. A catechism, called the National Electrical Catechism, is to be issued in serial form. The first number, just issued, contains seven questions and answers concerning electrical units. It is a two-leaf folder, 5 x 6½, with diagrams. The catechism will be mailed to anyone sending his address to the company.

Chain Drive.—The Morse Chain Company, Trumansburg, N. Y., sends its catalogue No. 7. It opens with an interesting article bearing the title "A Few Points on Chain Driving." This is followed by a detailed description of the Morse frictionless rocker joint and numerous illustrations showing different applications of chain drive. Suggestions for designing and ordering chain drive are also given.

Variable Speed Motors.—The Electro Dynamic Company, Bayonne, N. J., sends three circulars descriptive of its "Inter-pole variable speed motors." These motors are especially adapted for machine tool drive and can be set to run at any speed between 275 and 1,400 r.p.m. Illustrations showing these motors connected to various machine tools by means of gearing, chain drive and belt drive are also given.

Track Laying Machine.—The Hurley Track Laying Machine Co., Syracuse, N. Y., sends a folder descriptive of its track laying machine. Illustrations showing the machine in actual use are given, as well as a number of testimonial letters from those who have used the machines. It is claimed that this machine will lay track at the rate of 3½ miles per day of 10 hrs.

Graphite.—The Joseph Dixon Crucible Company, Jersey City, N. J., sends its February number of "Graphite." It is full of interesting matter pertaining to the various graphite productions made by this company, and it also contains its usual amount of light reading matter.

CONTRIBUTIONS

The Cole Four-Cylinder Balanced Compound.

Jan. 31, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Will you kindly allow me to apply to the discussion of the balanced compound locomotive the method of analysis developed by Mr. R. A. Parke, and described in his paper before the New England Railroad Club, Nov. 10, 1903. A portion of the paper was published in the *Railroad Gazette* Dec. 11, 1903. Mr. Parke deduces an expression for the normal force acting at the crank pin, due to the inertia of the connecting rod, cross-head, piston-rod and piston. If to the vertical component of this normal force there is added the vertical component of the tangential force, the sum is the force by which the inertia of these parts of the engine increases

or decreases the pressure of the wheel on the rail. But by a method very similar to that used by Mr. Parke, an expression for this vertical force can be obtained directly. It is found to be

$$Y = M_1\left(-\frac{\theta_1 k^2}{l\cos\phi} - \frac{p\,d}{l}\tan\phi + p\tan\phi + \theta_1 d\sin\phi\tan\phi + w_1^2 d\sin\phi\right) + M_2 p\tan\phi.$$

The symbols have the following significance:

Y = vertical force in question.
M_1 = mass of the rod.
θ_1 = angular acceleration of the rod $= -\frac{w^2 r(l^2-r^2)\sin a}{l^3\cos^3\phi}$
k = radius of gyration of the rod.
l = length of rod between centers of pins.
ϕ = angle between rod and line of centers of cylinder and driving-wheel.
p = acceleration of reciprocating parts $= w^2 r\left(\frac{\cos(a-\phi)}{\cos\phi} - \frac{r\cos^2 a}{l\cos^3\phi}\right)$
d = distance of center of gravity of the rod from the center of the crosshead pin.
w_1 = angular velocity of rod about the crosshead pin $= \frac{r\cos a}{l\cos\phi}\,w$
M_2 = mass of the reciprocating parts.
r = half of stroke, or length of crank.
w = angular velocity of driving-wheel.
a = angle between crank and a horizontal line extending backward, horizontally from the center of the wheel, and increasing positively as the engine moves forward.

In the accompanying diagram, curve No. 1 has been plotted to show the magnitude of this vertical force for the different crank angles, for a typical engine, at a speed of 60 miles per hour; curve No. 2 shows the normal forces; No. 3 shows the horizontal forces; No. 4 shows the vertical counterbalancing effect of a revolving weight sufficient to counterbalance the average horizontal force at the ends of the stroke. No. 5 shows the vertical counterbalancing effect of a revolving weight such as would be considered good practice for a two-cylinder simple engine; No. 6 shows the vertical counterbalancing effect of a revolving weight at the crank pin just equal to the weight of the crank pin end of the connecting rod; No. 7 shows the effect of a revolving weight which will just balance the vertical force when the crank angle is 90 deg.

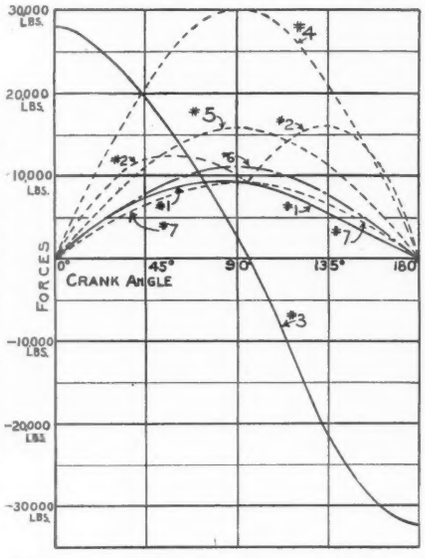
From the curves and the nature of the mechanical principle involved, the following truths can be deduced:

(1.) The lack of symmetry in the curves showing the horizontal and vertical forces due to the rod and the reciprocating parts, is due to the angularity of the connecting rod, and increases as the rod is shortened. In a balanced locomotive there is some slight unbalanced horizontal force, due to the angularity of the rod; but it is not due to difference in the lengths of the rods. An increase in the length of one rod will improve the horizontal balancing of the engine, whether the other rod is lengthened or not, if the other properties of the rod remain as favorable as before.

(2.) Ignoring the fact that the rods and reciprocating parts on the balanced compound may be much lighter than on a simple engine, the unbalanced horizontal forces have been reduced from about 17,000 lbs. on the simple engine to about 4,000 lbs. on the balanced compound.

(3.) The vertical balancing effect of the most efficient counterweight conforms very closely to the forces to be balanced, the greatest difference being but about 1,200 lbs. The vertical balance can be made perfect with all rods connected to the same pair of wheels.

Heretofore no consideration has been given to the effect of the steam pressure on the piston. This increases the pressure of the main driver against the rail on most types of locomotives when going forward, and decreases it when backing. It is for this reason that some types of engine slip more easily in backing than in going ahead. The weight added to the main driver is removed from the forward end of the engine by the upward pressure of the crossheads against the guide. The resultant of the supporting forces is thus shifted back of the center of gravity of the engine, and the couple thereby obtained resists the couple set up by the drawbar pull and the reaction of the rails. With a total piston pressure of 53,400 lbs. and a connecting rod three times as long as the stroke, this additional pressure of the wheel will amount to 8,900 lbs. if the engine is going so slowly that the inertia of the parts can be neglected. This is a downward pressure for both strokes, so that, if two such pistons are similarly connected to one pair of wheels, the total force due to the steam pressure is 17,800 lbs. per wheel. If the pistons are connected to different pairs of wheels, each wheel receives but 8,900 lbs. At high speeds, the pressure on the piston



Magnitude of Vertical Forces Produced by Locomotive.

at the middle of the stroke can be obtained from the indicator card, and from it must be subtracted the pressure necessary for the acceleration of the rod and reciprocating parts. From the remainder the resulting rail pressure can be calculated.

The pressure of crosshead against the guide has very much to do with the smooth riding of the engine. The shorter the connecting rods are, and the farther the crossheads are located in front of the center of gravity of the engine, the worse will be the effect of the crosshead pressure on the riding of the engine and in the endurance of the springs.

The couple resulting from the fact that the rods and wheels are not in the same vertical, longitudinal plane, can be balanced just as closely as the horizontal and vertical forces are, by an increase in the weight of the counterbalance and an angular displacement of it from the location opposite the crank pin, as explained in Mr. Parke's paper and in other works on counterbalancing. Such a displacement of the revolving weight on many of the balanced compound locomotives indicates that this refinement is often observed.

The advantages of driving two axles directly, each from a pair of cylinders can be stated as follows: (1.) The turning moments are distributed between the axles. (2.) The wheel pressures due to the work of the steam are distributed to four wheels instead of two. (3.) The outside connecting rod can be made longer, improving the horizontal balance and decreasing the crosshead pressure due to the steam. (4.) The outside crosshead can be placed nearer the center of gravity of the engine. The imperfection of the vertical balance seems to be its only fault, and that is so slight as to be of hardly more than theoretical interest. G. F. S.

Foreign Railroad Notes.

When the Austrian State Railroads asked for bids for rail supply for the coming year, the bids submitted by the Austrian mills, which are pooled, were considered too high, and the government asked them to bid again, but this time for the next five years, not for one. They finally came to an agreement, by which for the standard sizes, 60 lbs. to 84 lbs. per yard, $36.30 per kilometric ton will be paid, equal to $36.90 cents per ton of 2,240 lbs. The state will take on the average about 40,000 tons per year, a considerable amount going to the Alpine railroads.

With the purpose of increasing railroad income $5,000,000, the Russian authorities have issued a new passenger tariff, which may be very briefly described. Third-class fares are advanced by an almost insignificant amount (about 5 cents for 100 miles, 12 cents for 200, 20 cents for 1,000 or any greater distance), but second and first class fares, which have been 1½ and two times the third class, are made 1¾ and 2¾ the third class rates, which makes an advance of 16⅔ per cent. in the second class and 37½ per cent. in the first class. They remain pretty low, however, and for long distances very low. Thus the first class fare for 105 miles by the new tariff is $3.30, for 200 miles $4.90, for 1,000 miles $14.45. For the second class, which interests several times as many people, the new fares are more than a third less—$2.95 for 200 miles and $8.67 for 1,000.

Rails, for Lines with Fast Trains.*

BY P. H. DUDLEY.

(*Continued from page 53.*)

Chapter VIII. is devoted to a consideration of the micro-structure of steel rails. Acid tests for the entire section show whether the portion of the ingot from which it was produced was homogeneous and solid, or spongy near the center or in the corners. Such investigations assist in maintaining and improving the quality of present and future ingots if the tests are made systematically.

In reply to the question as to the most suitable micro-structure for rails considered as girders and for long-wearing rails, 21 of 46 answers received favored either a non-granular or fine granular structure. The terms "non-granular," "fine granular" and "coarse granular" are used to denote the absence of, or the comparative size of the cellular structure composed of ferrite, pearlite, etc., as shown in photo-micrographs. The three steel companies answering say that they do not know what structure is best for rails considered as girders and for rails

*Abstract of a report to be presented to the International Railway Congress to be held in Washington, D. C., May, 1905.

to resist wear due to wheel pressures and abrasion from flanges. Undoubtedly there is a difference in the physical structure of rails best suited for these two conditions of service.

The replies all agree as to the general fact of observation, that rails, the metal of which is designated as of "fine texture," "close grained," "non-granular or non-cellular," "a fine cellular structure," resist wear better than metal of coarse texture or structure. As these terms are used in common by those who prefer chemically hard rails, and those who prefer chemically soft rails, it is not an untenable hypothesis that there is some desirable quality of metal common to both grades of steel but in different degrees.

The writer in advocating what are designated as high carbon rails, that is, chemically hard steel, in distinction to soft steel, has insisted in practice that the hardness must be combined with a toughness, and be ductile instead of brittle, when the metal is strained beyond the elastic limits. What is required in rails, to sustain the wheel pressures of rolling loads, is mass hardness of the metal due to the alloy produced being of high elastic limit and ductile when exceeded, instead of mineralogical cell hardness with high elastic limit but fragile when exceeded. It is possible to have steel in rails of high elastic limits, in which hardness, firmness and toughness, as a mass, are combined, instead of a steel of coarse structure,

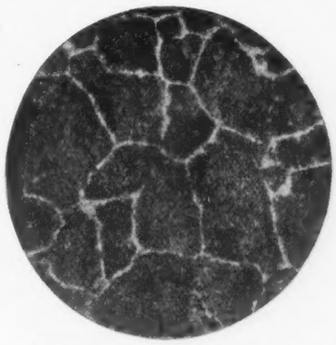


Fig. 1—Coarse, Open Grain.
Wears Rapidly.

of even lesser elastic limits and hardness, which may be fragile under ordinary usage, and decidedly brittle under shock. In the first instance, the elastic limits are from 60 to 70 per cent. of the ultimate strength of the metal, while in the latter they may be only 50 per cent. or less, as a result of the coarse cellular structure. It is this fact which has made it safe and possible to use the high carbon rails.

In steel rails and tires of wheels, metal for ordnance and small rifle barrels, which must withstand shocks, it is essential to have hardness, firmness and toughness combined as a mass in the steel, to absorb or distribute force collectively and not as individual cells. The metal has a high elastic limit in proportion to the ultimate strength. Such metal cuts readily in lathes and is called soft, when contrasted with more fragile metal of greater individual cell hardness. There is a decided distinction between the quality of "hardness" as applied to tool steels and springs, and the mobile mass hardness of steel rails. In tool steel the cell hardness must be sufficient to prevent the slightest distortion of the edges, while for proper mass hardness of the rail steel the edge should double over, without cutting. For rails and tires, the hardness desired refers more particularly to the mass of the dense and tough metal. The "non-cellular" structure with interlocking particles is advantageous in sustaining and distributing the wheel load forces to the metal throughout the section. The steel in the rail head immediately under the wheel contacts distributes its pressure more in relation to its cubic elasticity or of volume, than to linear elasticity as determined by the testing machine. For this purpose, it is essential when pressure is ap-

Fig. 2—Fine, Close Grain.
Slow wearing, 34 years' hard service.

plied by the rolling wheel contacts, that each minute portion of the steel is reinforced by the adjacent metal on either side and under it. In this quality of metal the mass is affected, rather than individual cells of a hard, well developed coarse structure in the rail head or in the tires.

At present we are without distinctive terms defining the quality of hardness of the metal in a mass as distinct from that of tool steel, which leads to confusion of ideas and practice, rather than of facts. In usage there are qualities of hardness which it is essential to produce in the rail heads, and also the tires of the wheels, for efficient, safe and economic service, in which there is a concensus of opinion, but a disagreement as to the limits of the chemical composition which will retain the qualities desired in manufacture. If it were only possible in the steel of the rails and tires to produce the same physical properties of hardness which are requisite in tools, then we should be restricted in the chemical composition of rails to lower limits than is the case where we may and should control in manufacture the quality of hardness best suited for the service.

The metal in the rail as a mass must be sufficiently hard and firm to resist decided permanent deformation as a section, both to sustain the wheel pressures on the head, or the fiber strains as a girder. In the top of the rail which sustains the wheel treads, a

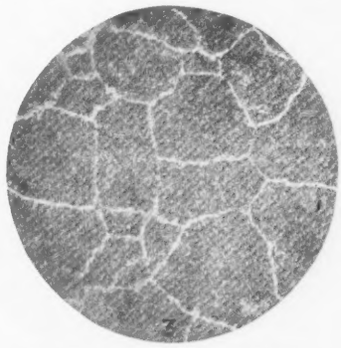


Fig. 3—Rapid Wearing Rail.
Stood Drop Test.

cold rolling of the metal, .01 in. deep, is permissible, but it should not crush underneath, shear, flow, and become rapidly detached. This is resisted best by metal which is close, without a large crystalline structure, having decided slip planes of weakness. It should partake more of the "non-cellular" interlocked or sorbitic structure which it is possible to produce in the rails, than large cells of pearlite surrounded by ferrite formed by a high temperature in rolling or in cooling of the rails from excess of residual heat. What the possible physical properties of this finer structure will be depends upon the chemical composition, the degree of heat to which the bloom and the rails are heated, and the temperature of the finished rail and subsequent cooling.

The last pass in the present cold rolling does not produce necessarily as fine a structure as is desirable for the best service of the rails for wear, though it is a step in the right direction. By the present methods, the elastic limit of the metal is reduced proportionately to the ultimate strength, which allows the rails as girders, under present service, to take permanent sets. This has been found to occur with 5⅛-in., 80-lb. rails which have been rolled cold. To maintain the necessary elastic limit for the cold rolled rails, the chemical composition has been increased. The colder rolling of the large sections has not been carried to as low temperatures as that of the best earlier sections, in which the elastic limit of the metal was 65 to 70 per cent. of the ultimate strength, some being rolled so cold that the elongation of the metal was only 6 to 8 per cent. in 2-in. specimens.

The output of the present heavier sections is seven or eight times as great as was the

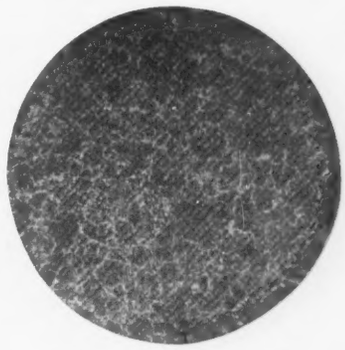


Fig. 4—Fig. 3 Reheated.

case with the lighter rails, and the rapid dissipation of the heat in the heavy rails is a serious problem. The early rails were rolled to, or below the critical points for the steel, and bunched upon the hot beds in the cooling and annealing, while to dissipate the heat, and for smooth finish in the larger sections, it is necessary to separate them on the hot beds in the mills, as at present designed. The service of the old rails, with the sorbitic or interlocked structure, was excellent for the wear, but it is not yet fully established for the heavier wheel loads, taking all matters into consideration—commercial as well as technical—that it will be possible to produce, at little expense, a similar texture. The rails of fine cellular structure have rendered excellent service in the tracks. Rails of 100-lb. sections with 48,400 to 70,000 cells per sq. in., have now sustained 250 million of tons, in track, and are yet in good condition.

The interlocked or sorbitic structure does not have as decided planes of weakness as the coarse cellular structure produced at high temperatures. In the latter, the steel is composed of cells of pearlite, each encased by a thin shell of ferrite, the pearlite composing the center. The surface of the rail becomes deformed under the wheel loads by breaking down and the ferrite slipping between each cell. The "non-cellular" or fine cellular structure can withstand greater pressures in reference to its cubical elasticity than the

coarse structure, as examination of the rail heads in the track under the microscope shows a series of flakes where the most intense wheel pressures occur on the rail head. The pearlite forming the inner portions of the cell becomes crushed, deformed, and slips, leaving numerous pits in the surface of the rail. The rail heads do not wear smooth, the surface being filled with minute irregularities, which is true also of the wheel treads. With a "non-cellular" or a fine grained steel in the heads of the rails, the surface wears smooth and bright. A softer or more rapid wearing steel does not have as bright and glistening an appearance. In nickel rails, in which the hardness is greater than in the soft steel rails, the structure was found to be cellular in several rails examined. The number of cells ranged from 69,600 to 115,600 per sq. in., the ferrite surrounding each being less than one-half of the thickness of ordinary steel of the same fineness.

On the inside head of the rail, to resist abrasion, the non-cellular structure or sorbitic is preferable to the coarse cellular structure, and is desirable for the rail as a girder, although it should be carried to that quality of hardness which characterized the earlier steel. The colder rolling now practiced reduces the size of the cellular structure, and lowers the elastic limits, instead of raising them as would be the case were sorbite produced. From the experience with the earlier rails of a sorbitic instead of a cellular structure, the wheel loads were so much less than at the present time, that apparently the wear per ton was several times slower than on recent sections. The intensities of the wheel pressures are now three to four times greater than under the light wheels. The limber rails in the track took sets, and at the joints the facing ends were cut out from $^1/_{16}$ to $\frac{1}{8}$ of an inch deep, after sustaining a traffic of 50, 60 or 70 million tons. Then it was necessary to take them up, cut off a portion of the end, redrill and relay them. The older rails had many defects such as portions of the head splitting from one side, breaking at the bolt holes, and mashing at the joints. Part of this was due to the weak fish plates forming but a partial support for the rail ends.

While it is possible that a structure of the rails approaching sorbite or non-cellular as in the old rails, might be desirable for use, it would increase the cost and restrict the output, until a different process of cooling was substituted for that now in use.

Mr. Robert Job, Chemist of the Philadelphia & Reading, states that "in a lot of over 75,000 tons of rails observed during a period of five years, we have 15 times as many fractures in service from rails of the micro-structure shown in Fig. 1, "coarse cellular," 19,600 cells per sq. in. as from rails of medium fine structure, 48,400 cells per sq. in., and there is also a marked difference in capacity for wear in favor of the finer structure rail. . . . The drop test merely shows whether or not the steel is fairly free from brittleness, but gives little or no indication as to capacity for wear. Since a structure even such as Figs. 1 and 3 will stand the drop test, provided other sources of brittleness, such as piping or burning of the steel are absent, we must consider a clause in any specifications demanding a structure of more than 40,000 cells per sq. in. as absolutely essential to ensure rails of fairly satisfactory wearing qualities. Out of several thousand tons of rails now in our tracks, made under such a specification, only one rail has fractured in service, and that one owing to pipes in the steel, in process of manufacture.

"The tensile strength of Figs. 1 and 3 is 128,400 lbs. per sq. in., with an elongation of 8½ per cent. in 2 in. That of a rail with a structure of 48,400 cells per sq. in. approximates 130,000 lbs. per sq. in., elastic limits 78,000 lbs., with 13 per cent. elongation in 2 in., the composition of both lots being practically the same."

Regarding Mr. Job's reference to the drop test, it is proper to say that the writer uses the drop test to determine the toughness or brittleness of the finished section and also other physical properties of the steel essential for wearing capacity under the wheel pressures, and the fiber strains as a girder in their distribution. It was from knowledge of the physical properties of the metal secured by drop tests, that several hundred thousand tons of rails were rolled for the New York Central. Their service in the track shows a slower comparative rate of wear than those chemically softer in identical sections, for the same traffic. Their micro-structure is cellular, 48,400 to 69,600 cells per sq. in.

Milk Business on Electric Roads.

The freight and express business done by electric roads, and the remarkable growth of this source of earnings, following the development of interurban systems, has frequently been discussed in the *Railroad Gazette*. Although the best opinion holds that heavy freight traffic, which tends to disturb the natural passenger-carrying function of a trolley road, is undesirable, it has been repeatedly proved that there is considerable profit in handling light freight and express goods; particularly packages for house-to-house delivery along the route, and perishable freight, such as garden truck, originating in the territory through which the road passes. Good statistics of this traffic are scarce, as the reports issued by the companies usually fail to separate freight from passenger earnings, or, if they do separate them, classify freight earnings in with receipts from car advertising and miscellaneous receipts.

Name of road.	Milk carried regularly?	No. of cans collected and returned daily.	Special cars used?	No. of loading platforms.	Special depot at city terminal?	Greatest haul. miles.	Average haul. miles.	Rate.	Empty cans delivered, at night or in the morning?	Growth of the traffic?	Have the steam roads in your territory lost much of the milk business?	Rate per can of 40 qts on the steam roads competing?
Albany & Hudson	Yes.	70 to 90	1	12	No.	25½	12	12½c. per 40-qt. can, any distance.	Morning.	....	No; the business created by the electric road.	Min. 20c. per can of 40 qts.
Aurora, Elgin & Chicago	Yes.	135 to 150	Yes	15	Yes.	27½	13	15c. pr 40-qt can, all distances.	Morning.	Rapid.	All that the electric road has gained.	The same.
Canton-Akron	Yes.	50	Yes	25	Yes.	..	..	1½c. per gal., all distances.	Morning.	All in 1 year.	....	1½c. per gal.
Chicago & Milwaukee Elec.	Yes.	150	Combnatn.	10	No.	25	..	3c. per gal., all distances.	During day.	Doubled in two years.	Part; farmers' and delivery wagons the rest	The same.
Cin., G. & Portsmouth	Yes.	30 to 40	Yes	7	Yes.	..	..	2c. per gal., all distances.	Evening.	....	No competition.	...
Clev. & S. W. Traction	Yes.	375 avg.	Yes	72	Part.‡	..	..	10c. per 40-qt. can, first 20 mls., 15c. beyond that.	Afternoon.	St'dy increase.	Yes; they carry very little now.	About same as electric
Dayton & Wstn Traction	Yes.	20	No	5	No.	15	9	2c. per gal.	Both.	Very little.	No competition.	....
Detroit United	Yes.	600	...	60	Yes.	60	30	Avg. abt. 9c. per 10-gal. can.	Evening.	Steady.	Yes	1c. per gal.
Ind., & N.-W. Traction	Yes.	25 to 30	No	4	Yes.	..	..	1½ to 2c. pr gal.	Morning.	All in 1 year.	Business mostly created by electric.	About 2c. per gal.
Ind., Col. & Southern Tr.	Yes.	225	Yes	18	Build'g.	20	10	First 10 mls. 1c. per gal.; second 10 mls. ½c. extra.	Both.	Began 4 years ago with 35 cans a day.	They did but little milk business.	....
Interurban Ry. & Tr.*	Yes.	130 to 165	Comb.†	6—8	Yes.	..	..	2c. per gal., all distnes. 1.85c. on large contracts.	During day.	10 to 150 cans. in 1 year's operation.	Almost all.	2½c. per gal.
Lake Shore Electric	Yes.	40 to 50	Combnatn.	..	No.	60	..	1½c. per gal.	....	Not specially interested.	Considerable.	The same.
Rochester & Sodus Bay	Yes.	50	No	13	Yes.	32	20	24-qt. can., 10c. 32-qt. can., 12c. 40-qt. can., 15c. All distances.	Night.	Formerly 140 cans; ch'k'd when creamery was built.	No.	½c. per gal.

*Of Cincinnati, Ohio.
†Combination of passenger and express.
‡Part unloaded at city limits, part at depot.

The advance sheets of the report of the New York Railroad Commission for the year ending June 30, 1904, furnish interesting data on this subject. With 1,995 miles of electric lines included in the returns, 633,674 tons of freight were carried last year, as against 516,460 tons in 1903, 394,641 tons in 1902, and 287,311 tons in 1901. Earnings from freight and express traffic increased during the same period from $175,931 to $517,780. In brief, while earnings from the main source of income, passenger traffic, increased 19 per cent. in four years, earnings from the by-product of the lines furnished by freight and express traffic, increased 194 per cent.

A branch of light freight business which an interurban road is particularly well fitted to undertake is the milk traffic in the vicinity of small cities. As a substitute for milk stations three or four miles apart, involving a considerable haul in teams from the farms, and return of the empty cans at night in the same way, it is a simple matter for the trol-

ley road to arrange to receive milk direct at each farm it passes, thereby not only profiting by the introduction of the element of convenience, which has been so important in building up trolley passenger traffic, but also by the fact that it can deliver the milk in the city in better condition than is the case after it has been shaken up in the farmer's wagon, on the way to the railroad station.

A circular letter was recently sent to a large number of electric lines, asking for a report on this branch of the traffic, and the tabular matter on page 118 has been prepared from the roads which replied.

Although the number of replies received was not great enough to permit of much generalization as to results, it will be seen that the rates vary considerably, from a maximum of 3 cents per gallon on the Chicago & Milwaukee Electric line to a minimum of less than a cent a gallon on the Detroit United. As would naturally be expected, the rates are quite universally competitive, there being only two or three roads that report no competition, and the trolley rates, when not the same as the steam rates, are generally slightly less. There is one interesting exception to this, and that is the Rochester & Sodus Bay road. It will be recollected that this line, which was described rather fully in the *Railroad Gazette* of Aug. 21, 1903, parallels the Rome, Watertown & Ogdensburg along the southern shore of Lake Ontario almost all the way to Sodus Bay, 40 miles from Rochester. The country in between is thickly settled with prosperous towns, and is a great producer of fruit, vegetables, and country produce consumed in Rochester. The Rome, Watertown & Ogdensburg has fought the Rochester & Sodus Bay line ever since the latter was opened in July, 1900, and at last reports was quoting both passenger and freight rates considerably lower than those of its electric competitor. The electric road has been able in spite of this to get the lion's share of the passenger traffic, owing to its frequent service and to the fact that the cars run through the streets of the towns; but it will be observed that the Rochester & Sodus Bay reports that the Rome, Watertown & Ogdensburg has not lost any milk business as a result of its competition, and that the milk business of the electric road has fallen off from 140 cans a day to 50 cans a day, owing to the building of a creamery.

Perhaps the most interesting information which can be gathered from this table is that in all but a few cases, milk traffic has shown rapid increases in the year or so that it has been carried on, and seems in a fair way to furnish the trolley roads with a very nice profit from runs in the early morning and late evening hours, respectively before and after the rush hours. It would seem that the item of convenience, referred to above, would render it extremely difficult for a steam road to compete with a trolley road in handling this traffic from localities where the electric line runs adjacent to the farms. The Rome, Watertown & Ogdensburg is apparently able to hold its traffic along Lake Ontario at the rate of one-half a cent per gallon, returning the cans free. Whether it is profitable to do the business at this rate is doubtful.

Within the last few years it has been quite common for the interurban lines to build terminal stations for handling their freight and express goods, and the milk cans as a rule are delivered direct to these stations. In some cases they are distributed to dealers throughout the city. The Detroit United lines have a very large depot at Detroit, recently built, where the milk is distributed. In the reply which was made by the Detroit United to the circular letter, it was pointed out that the rate differed on the different lines of the company and was chiefly influenced by wagon rather than by railroad competition. This brings up another interesting point which is touched upon in some of the replies, and that is that, as with the passenger traffic, though not to so large an extent, much of this milk business is created for the trolley lines instead of being taken away from the steam road. The farmers simply put their cans of milk on the trolley cars instead of teaming them all the way into the city. At first glance it would appear that this change must add a good many hours of sleep to the night's rest of the farmers living in the vicinity of the trolley lines! It is also interesting to note in the Detroit United letter that there is a maximum milk haul of 60 miles, presumably in the baggage compartment of the special express cars, which run to Flint, Port Huron and other points. In previous articles in the *Railroad Gazette* it has been pointed out that this service of special fast cars from Detroit approximated railroad speed for what would have been considered an impracticably long electric haul a few years ago.

In addition to the table of roads printed above, replies were received from a number of other electric lines which were not engaged in the traffic. Nine of these roads are apparently not interested in the subject at all; four others express an intention to develop milk traffic as soon as can be arranged. Insignificant as the totals from this kind of traffic are in comparison with the gross earnings of the electric railways, it is nevertheless interesting to see the progress which has been made in developing business which was quite unthought of in the days of the old street cars. The first extension of field was when the cars began to carry mail; the next was when they became engaged in the package business, while the collection of garden truck, fruit and milk, on account of the special facility with which it can be done in electric cars, evidently belongs in a more advanced class by itself. The hauling of heavy freight, as has been attempted on several roads, need not be considered as a practical and increasing development of the possibilities of the trolley lines at present.

Decision Against the Atchison.

The Interstate Commerce Commission on February 3 issued a report and opinion on the Colorado coal-rate case which has been a subject of general public discussion for several weeks past. The rehearing which had been asked for by the president of the Atchison, Topeka & Santa Fe, as noted in the *Railroad Gazette* of January 13, was not given, as the road withdrew the request. An abstract of the report follows:

The present proceeding was begun on representations made to the Commission by the Caledonia Coal Company, operating a coal mine at Gallup, N. Mex., that the Atchison, Topeka & Santa Fe was discriminating against it in favor of the Colorado Fuel & Iron Company. A contract of the Santa Fe with the Caledonia Company expired in 1898 or 1899, and was not renewed, and when it attempted to find a market for its steam sizes of coal, it ascertained apparently that coal, both from the Trinidad region and from the mines at Gallup, was being supplied at a price which about equalled the freight rate alone from the point of production to destination. No other individual could do business in competition with the Colorado Fuel & Iron Company in this field unless he enjoyed the same freight rate advantages; when other individuals endeavored to make contracts in competition with the C. F. & I. they were compelled to pay the published rate; and therefore were unable to furnish the coal; and under this arrangement the Santa Fe and the C. F. & I. virtually entered into a partnership in the handling of this coal, in the execution of which the published schedules were utterly disregarded.

A number of other operators in New Mexico found it difficult to dispose of their products in competition with the C. F. & I. The Santa Fe acted as agent for the C. F. & I. in collecting from its customers the price of the coal itself along with the freight rate, and in one instance, at least, this also was done for the Victor Fuel Company. Under this arrangement the Santa Fe instructed its agents to bill coal to various stations at figures to be furnished by the C. F. & I., and the practice seems to have been to embrace the price of the coal and the freight rate in a single item, which appeared on the bill as freight.

If the C. F. & I. had in all cases paid the published tariff rate which was exacted from other shippers, the fact that the price of the coal and the freight were included in a single item would have worked no practical advantage to that company. Neither, apparently, would there have been any reason for this arrangement if the purpose of the parties had been honest. During the entire period covered by this investigation, the Santa Fe did transport coal for the C. F. & I. for less than its open tariff rates. Mr. Biddle, freight traffic manager of the road, testified that of the $4.05 received by the Santa Fe, $1.15 was always paid to the C. F. & I., with the full knowledge of the El Paso & Southwestern. Some suggestion has been made that these payments to the C. F. & I. by the Santa Fe were not in the nature of rebates, but simply payments for the price of its coal; that the published tariffs in reality included the cost of the coal, but inadvertently omitted to state that fact. The record conclusively shows the contrary.

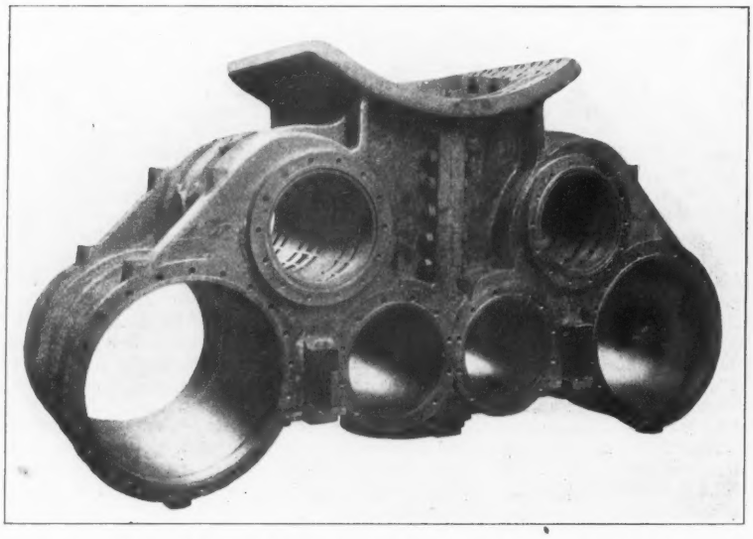
It was said that these rates in favor of the C. F. & I. worked no discrimination, as there was no other shipper, and consequently no actual preference. The Santa Fe published its rates, and these rates were actually insisted upon in the case of small consumers apparently, but whenever it seemed desirable, to secure a particular contract, to shade the price, a special arrangement was made between the Santa Fe and the C. F. & I., by which the road agreed to transport the coal required to fill that contract for less than this published rate. Since the greater part of the business of that coal company was in filling these large contracts, the rebate was applied to the greater part of its total shipment. Nobody else sold to these large consumers, because in the very nature of things nobody else could sell. These tariffs from the Trinidad district served as scarecrows to keep off all competitors, and, further, as a pretext for declining to reduce rates from other coal fields, on the ground that there ought to be some relation between different districts. It has been intimated in some quarters that the Santa Fe in the payment of these rebates squandered its revenues. That phase of the subject was not under investigation, but nothing appears in this record to justify that suggestion.

The act to regulate commerce requires carriers to publish and adhere to their tariffs. The Atchison, Topeka & Santa Fe has for the last five years wilfully and continuously violated the provisions of this law. Feb. 19, 1903, the so-called "Elkins bill" was enacted, providing that carriers should in no case transport traffic until a tariff had been published, and that the published tariff should be observed, and providing a penalty of not less than $1,000 nor more than $20,000 for each offence. The provisions of this statute extend both to the railroad company which grants and the party which receives the concession. Both the Santa Fe and the Colorado

Fuel & Iron Company systematically and continuously violated the provisions of that act from the day of its passage down to Nov. 27, 1904, when the tariffs under which this coal moved were reduced in all cases $1.15.

It would seem that the El Paso & Southeastern was also in violation of the same statute during that period, but that company was not a party to this proceeding and has not been heard.

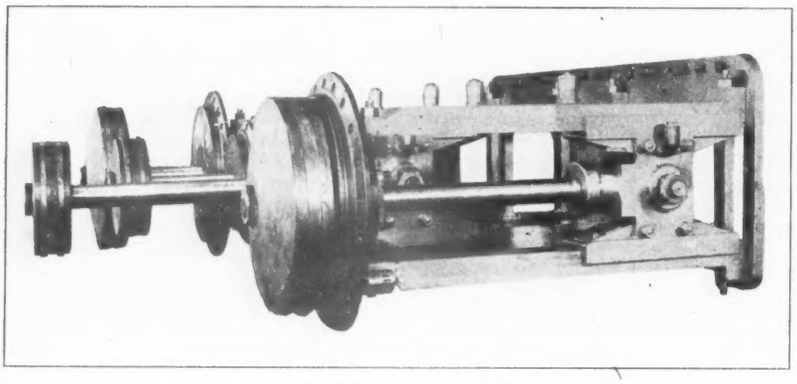
On March 25, 1902, the United States Circuit Court, in a suit begun at the instance of the Interstate Commerce Commission, enjoined the Atchison, Topeka & Santa Fe to observe in all respects its published schedules of rates. That company, from the date of this injunction down to Nov. 27, 1904, was apparently in continuous disregard of that order of the court in its failure to maintain these coal tariffs.



Cylinder Saddle—Baldwin Four-Cylinder Balanced Compound.

Advantages of Four-Cylinder Balanced Compound Locomotives.*

The prevailing conditions in railroad passenger traffic demand the highest practicable rate of speed with the heaviest possible load. Trains with loads of from 300 to 600 tons behind the engine are required to attain a sustained speed of at least 50 miles per hour, and those of 200 to 300 tons a speed of 60 miles per hour. Instances may be cited where, in order to maintain the schedule time, it is necessary to cover a distance of nearly 40 miles, on comparatively level track, at a speed of 80 miles per hour, and this, not for one day but every day in the year.



Arrangement of Cross-Heads and Pistons.

That a single-expansion locomotive, properly designed, can do this work is not denied; but experience has shown that the dead weight required for such a locomotive, the increased strains and internal friction, together with the difficulty in properly counterbalancing the driving wheels, is liable to make the wear and tear on the track excessive. Aside from these difficulties the firing of the locomotive under such conditions becomes a question of moment, as it is practically impossible for one man to handle the necessary amount of coal to keep up the requisite steam.

The advantages that are obtained from compounding the steam used in a locomotive are well-known, but they may be briefly stated as follows: (1.) Greater efficiency of boiler, for the reason that proportionately less steam is used than in single expansion locomotives. A lesser rate of evaporation is required. (2.) A lighter final exhaust to the stack, by which means a more complete and slower rate of combustion is maintained. (3.) A higher boiler pressure can be advantageously used, and consequently drier steam obtained. (4.) A greater range of expansion is obtained because the initial pressure is higher and the exhaust pressure is lower than in single-expansion cylinders. As the expansion is divided between two cylinders, the relative temperature of the two will be higher and result in decreased cylinder condensation.

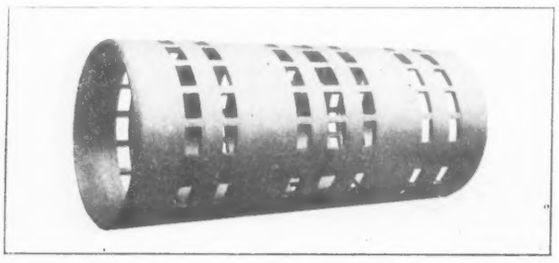
All of these advantages tend to give an economy in the use of fuel and water, which reaches to from 15 to 25 per cent., depending on the conditions of service. It has been maintained by some that the increased cost of repairs in the present types of compound locomotives more than offsets the amount saved by fuel economy. This criticism has led to further improvements, and the introduction of the four-cylinder balanced compound locomotive. The first locomotive of the Baldwin four-cylinder balanced compound system was built in January, 1902, for the Plant System. This locomotive attracted much attention at the time, and its record was anticipated with widespread interest. It was, however, too heavy for use on the Plant System and was sold to the Chicago Short Line. It was of the ten-wheel type.

As is common to locomotives of this system, the low-pressure cylinders are placed outside the engine frames, connections being made with crank pins on the driving wheels. This is to avoid stressing the crank-axle by the heavy pressure in the low-pressure cylinders in starting. The high-pressure cylinders are inside the frames in the same horizontal plane as the low-pressure, and connection is made with a cranked driving axle. In the Plant locomotive referred to above all four connecting rods are coupled with the front axle.

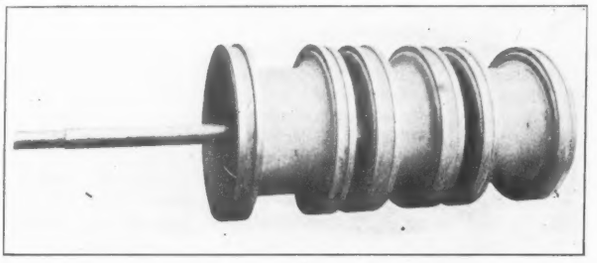
The cylinder saddle is cast in two parts and bolted together in the usual way, each half containing a high and low-pressure cylinder and a single valve which controls the admission of steam to both cylinders. This admits of the use of the ordinary Stephenson type of valve motion the same as is used in single-expansion locomotives. The valve is of the piston type with central steam admission, and slides in a machined bushing, which is forced into the cylinder saddle. A single reverse lever in the cab is all that is required.

The live steam port in this design is cen-

*From "Record of Recent Construction," No. 49, issued by the Baldwin Locomotive Works, 1905.



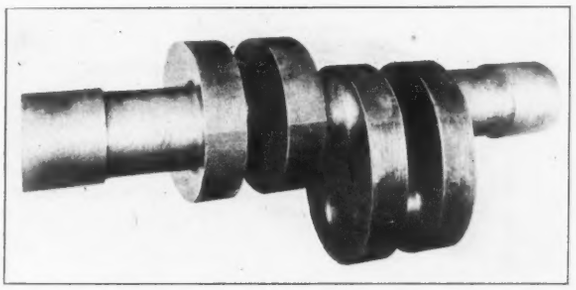
Valve Bushing—Baldwin Balanced Compound.



Piston Valve—Baldwin Four-Cylinder Balanced Compound.

Rail Damaged by Imperfectly Balanced Locomotive.

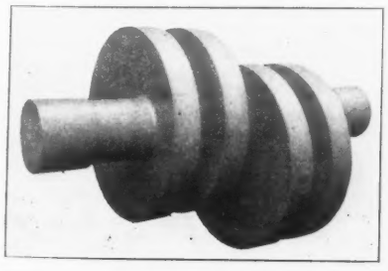
trally located between the induction ports of the high-pressurre cylinder. Steam enters the high-pressure cylinder through the steam port and the central external cavity in the valve. The exhaust from the high-pressure cylinders takes place through the opposite steam port to the interior of the valve, which acts as a receiver. The outer edges of the valve control the admission of steam to the low-pressure cylinder. The steam passes from the front of the high-pressure cylinder



Crank Axle.

through the valve to the front of the low-pressure cylinder, or from the back of the high-pressure to the back of the low-pressure cylinder. The exhaust from the low-pressure cylinder takes place through external cavities under the front and back portion of the valve, which communicate with the final exhaust port. The starting valve connects the two live steam ports of the high-pressure cylinder to allow the steam to pass over the piston. One of the illustrations shows the relative position of the cross-heads and pistons in a four-cylinder balanced compound locomotive.

In each wheel, opposite the crank, is placed a certain weight, which is the exact equivalent of the weight of the revolving parts comprising the wrist pin, wrist pin hub, stub, one-half the coupling rod, and on



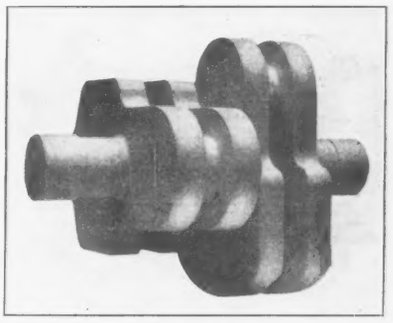
Built-up Disk Axle.

the main pin two-thirds of the main rod. The two opposing weights exert the same force throughout the entire revolution, and balance each other. If the revolving parts were the only ones to be considered, the wheels could be easily balanced, but the reciprocating parts must be provided for. These, comprising a portion of the weights of the piston, piston rod, cross-head and front end of the main rod, exert a force in a horizontal direction upon the crank pin which is unequal during the revolution, being greatest when the pin passes the dead center, and least when the half stroke point is reached. It is absolutely necessary to provide some means for balancing this weight, and in an ordinary locomotive an additional counterweight is placed in each driving wheel. This can be made to balance the parts exactly only at portions of the stroke, so that when the counterweight has reached one portion of the revolution there is no equivalent weight opposite, and with a heavy locomotive at high speed, with comparatively light rails, results as shown in the accompanying illustration may occur. This photograph shows the condition of the rails on a section of track after an Atlantic type locomotive of ordinary construction had passed over it at a speed of about 80 miles per hour. The road here running over swampy land, had been changed from single to double track, consequently the foundation was more compact at the center than at the outer portion, otherwise undoubtedly the effect noticed on the outer rail would have been apparent on the inner as well.

A four-cylinder balanced compound locomotive built for the C., B. & Q. (see *Railroad Gazette*, June 3, 1904) differs from the one previously noted in that the main crank pin for the high-pressure cylinder is placed in the second instead of the first pair of driving wheels. On each side of the engine, while the reciprocating parts in connection with the high-pressure cylinder are moving in one direction, those in connection with the low-pressure cylinder are moving in the opposite direction. These parts having the same rate of speed, and being practically of the same weight, exert an equivalent force in opposite directions at all points and balance each other. This leaves only the revolving parts to be compensated for in the driving wheels, and these can be exactly counter-balanced. The two pistons on each side of the locomotive, traveling in opposite directions, equalize the longitudinal strains, and prevent what is termed the "nosing" action. This relieves the track from injury and adds to the safety of the locomotive and to the comfort of the engineer.

The strain upon the rail exerted by the unbalanced engine must be taken into consideration in estimating the safe wheel load which the rail can sustain. It is evident, therefore, that if this unbalanced feature is done away with, the safe axle load can be increased, allowing greater weight to be carried on the driving wheels, resulting in the development of greater tractive power and the possibility of hauling heavier trains.

The arrangement of the coupling rods is as follows: The crank on the axle and the crank pin in the driving wheel for the corresponding high and low-pressure cylinders are set at an angle of 180 deg., the two axle cranks being set at 90 deg.; this brings the action of each high and low-pressure cylinder on one side of the locomotive, quartering with those on the other side, and four points of connection are provided, equally distributed about the central axis. This arrangement, to a great extent, neutralizes the unequal rotative moments due to the angularity of the main rods. Four sets of rods, guides and pistons are used, but the strains are so distributed between them as to make it possible to lighten the weight of each and still have ample strength for maximum requirements. This division of the strains de-



Built-up Axle—Weights Balanced in the Same Plane.

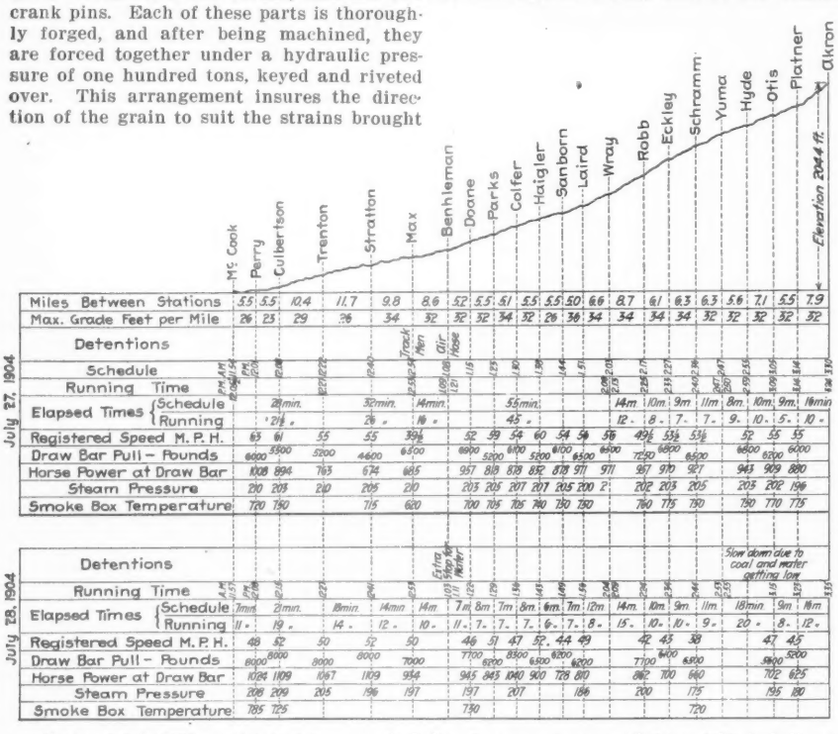
creases the wear and tear on the moving parts and compensates for the increased number.

Locomotive No. 507, built for the Atchison, Topeka & Santa Fe (see *Railroad Gazette*, Jan. 22, 1904) is one of 60 recently furnished that road. It is a balanced compound Atlantic type locomotive, and formed part of the exhibit of the Baldwin Locomotive Works at the Louisiana Purchase Exposition. In this locomotive the four main rods are all connected with the front axle; the two outside from the low-pressure cylinders to the crank pins in the driving wheels, and the two inside from the high-pressure cylinders to the axle cranks. With this arrangement all the main rods are of the same length and practically the same weight, so that one set will balance the other. Although the rods are comparatively short, the vertical strains on the guides will not be as great as with an ordinary locomotive with much longer rod, for the reason that the thrust caused by the cylinder pressure is carried through two rods instead of one.

The balanced system of locomotives requires the use of a crank-axle, but in view of the fact that this style of axle is successfully used in foreign locomotive practice, it is reasonable to suppose, that with the decrease in the strains brought about by the balanced compound principle, the prejudice against the crank-axle will be overcome. Every effort has been brought to bear to increase

the strength of the axle and insure satisfactory results. Two different designs have been used, one of these is shown here. It is of nickel steel and forged in one piece. The center or neutral axes of the crank pins are drilled and a 4-in. steel pin is forced into the opening under hydraulic pressure and riveted over the cheeks. This gives increased strength and additional security in the event of the pin becoming cracked. A steel band is also shrunk around the outer surface of each cheek.

Another form of axle is that shown in an accompanying illustration. This is what is termed the "built-up" disk axle. It is in nine pieces forged separately. They consist of the three parts of the axle proper, the four disks which form the cheeks, and the two crank pins. Each of these parts is thoroughly forged, and after being machined, they are forced together under a hydraulic pressure of one hundred tons, keyed and riveted over. This arrangement insures the direction of the grain to suit the strains brought upon the axle. An illustration shows a built up axle designed so that all the weights are balanced in the same plane. This type of axle is not stressed by the effect of the "whip" at high speeds, and there is likewise no gyroscopic effect by balancing different weights in the same plane.



Train of July 27th consisted of ten cars, including dynamometer car. Total weight, including engine and tender, 644 tons. Coal used, 8 tons. Time running, 2 hrs. 56½ mins. Average speed, 48.6 miles per hour.

Train of July 28th consisting of twelve cars, including dynamometer car. Total weight, including engine and tender, 719 tons. Coal used, 9 tons. Time running, 3 hrs. 23 mins. Average speed, 42.26 miles per hour. Average drawbar pull, 7,820 lbs. Average horsepower, 766. Evaporation, 56 lbs. water per lb. coal.

Record of Test Runs—C. B. & Q. Locomotive No. 2700.

The accompanying graphical record gives the results of tests on the C., B. & Q. In traversing the line from McCook to Akron, a distance of 143 miles, the train is elevated 2,100 ft. With an Atlantic type compound locomotive, having a weight of 91,000 lbs. on the 84-in. driving wheels, seven cars was the limit of train load. With No. 2,700, having 100,000 lbs. on 78-in. driving wheels (cylinders and other conditions being similar) a train of 12 cars was hauled on schedule time. The diagram herewith shows the profile of the division and a synopsis of a number of runs made.

South Carolina Railroad Commission.

The Railroad Commissioners of South Carolina, Messrs. C. W. Garris, J. H. Wharton and B. L. Caughman, have issued the twenty-sixth annual report of the commission. It is dated January 1, but is for the year ending last June. The number of miles of railroad in the state June 30, 1904, was 3,134. The commissioners ask for a larger appropriation for printing annual reports, the 500 copies heretofore issued being insufficient. An appropriation is also wanted for promulgating the changes in rates of transportation which the commission orders from time to time. At present these rates are not published by the commission.

Many complaints have come before the board during the year, but, say the commissioners, "it is useless to detail the work done in this line," indicating a position which is in pleasant contrast to that of some other state commissions which we could name. On one complaint, however, the facts are given in considerable detail; that of the Charleston Freight Bureau asking for a general reduction in freight rates. The commissioners find that the allegation that rates are lower in adjacent states is not supported; if there is a lower *average* rate in other states, it is because in those states there is a larger movement of coarse freight, which goes at low rates in every state. The one point in which South Carolina citizens are perhaps at a disadvantage—that in trunk line rates from the west—is held to be due largely to the fact that Richmond, Va., the city which is said to enjoy a preference, is probably entitled to lower rates on account of the large volume of its business; and, in any event, the commissioners of South Carolina have no power to deal with Richmond rates. They are bound to protect South Carolina in any way that they can; "but we cannot construe the law as directing us to so manipulate the rates in this state as to deprive our citizens of their freedom to enter any market, whether in this state or out of it, there to obtain freely any natural advantages that may be offered by such market. To deny this would be to deny the principle of free trade; and to prohibit free trade by an arbitrary adjustment of rates to protect a market would amount not only to a deprivation of trade liberty, but to a tax on the consumer, whom we are first bound to regard." Finding, therefore, that, as before stated, rates are not higher than in other states, and that the railroads of South Carolina ought to improve their tracks and bridges, so as to bring them up to a higher standard, it is decided that a general reduction of rates would not be justified. Passenger rates are already less than in North Carolina.

The commission some time ago ordered reductions in telegraph tolls; but if adequate control of telegraph companies is to be exercised, power should be given to define delivery limits in towns and to say when a town should have an office separate from the railroad office. The commission was authorized last year to compel different telephone companies to connect with each other and work together, but it has not been found possible to formulate an equitable plan by which this can be done. Two companies working a line jointly have no means of fairly fixing the responsibility for faults or inefficient service. The commissioners therefore recommend that the law be changed so as to put telephone companies on the same basis as telegraph companies. Under the head of accidents, the commissioners, referring to the Catawba River disaster Sept. 9, 1904, say that the time interval between trains is too short, and that colored men are not suitable for the position of flagman on the rear of a train.

French Railroads in 1902 and 1903.*

BY C. COLSON,
Engineer-in-Chief of Roads and Bridges in France, Councillor of State.

The financial results of 1902, as compared with those of 1901, appear to be very satisfactory everywhere. The increase in the earnings, although not great, has been appreciable, and the expenses have either become reduced, or else increased very slightly, so that the net profits have distinctly increased in all three countries. But it must not be forgotten that 1901 was a disastrous year for all transport business; comparisons made with it alone do not, therefore, lead to a proper appreciation of the results of the succeeding year. On the other hand, the previous years had been boom years, which also do not form a good standard of comparison.

In order to grasp what the progress has been, we will go back to 1895, which year may be considered a normal and average one; the effects of the exceptional depression due to the 1893 crisis had been worked off and business had not yet entered upon the extraordinary period of prosperity which characterized the last few years of the century. Starting from 1895, the progress of the traffic was first of a normal character, and then suddenly went forward by leaps and bounds, so that during 1899 and 1900 there was a true crisis, but in the inverse sense of that of 1893; it was extremely difficult to operate an over-congested service. In 1901, on the other hand, a distinct retrograde movement made itself felt, and what there had been of excess of traffic during the previous years was lost; but it could not be asserted that the earnings fell to below what they would have been, had the progress been normal and regular. The high cost of coal, however, the result of the brisk industrial demand of the preceding years, had made all contracts made during those years very unprofitable; moreover, the services had to be multiplied to meet the abnormal requirements which did not keep up, so that the working expenses had increased quite out of proportion, and it was this more

*From a paper entitled a "Review of Traffic Questions," in the *Revue Politique et Parlementaire*. Reprinted in the *Bulletin of the International Railway Congress*.

than anything else, which made the results of 1901 such deplorable ones. In 1902, the influence of these exceptional conditions had become largely attenuated, but had not yet quite disappeared. For these various reasons we have compared the results of 1902 with those of 1895, in order to give an idea of the progress of traffic in France, England and Germany. As for the last country, we have had to apply an appropriate correction, in order to allow for a material alteration introduced in 1898 into the form in which the statistics of receipts and expenses are drawn up; otherwise the relative correctness of the figures applying to the two would have been impaired.

The total increase of receipts was greatest in Germany, and averaged 3.9 per cent. per year; it is not surprising that a country which has but recently started large manufacturing industries should develop its traffic at a quicker rate than countries which have been utilizing their resources for a long time. England, which has reached a condition where progress can no longer be so rapid, nevertheless shows almost as great an increase, averaging 3.4 per cent. per year; in railroad matters as little as in maritime matters, do these figures show any of the pretended decline so much talked about and used to-day as a pretext for the attempts made to induce England to change the commercial policy under which it has obtained such marvellous results. The progress has been least in France; the increase in the earnings has only averaged 2.2 per cent. per year, *i. e.*, not two-thirds of that realized in the other two countries which we are considering.

This is not surprising, as the population which travels on the railroads and which produces and consumes the goods which are carried on railroads is very far from increasing with us at the same rate as with them. Similarly the output of coal, which may be considered the best measure for the natural suitability of a district for large manufactories, is much smaller in France than in the neighboring countries. And these two factors are always the most important ones as far as railroad receipts are concerned. The following table gives the particulars, for the same period of time:

COMPARATIVE RESULTS, RAILROADS IN FRANCE, ENGLAND AND GERMANY.

	France.			England.			Germany.*		
	1900.	1901	1902.	1900.	1901.	1902.	1900-01.	1901-02.	1902-03.
Average mileage	23,488	23,675	23,861	21,811	21,997	22,121	30,883	31,504	32,125
Passenger earnings	$101,282,400	$93,312,000	$94,284,000	$186,818,400	$191,872,800	$194,594,400	$133,747,200	$133,358,400	$134,524,800
Express freight.†	29,937,600	30,132,000	31,687,200	35,769,600	36,936,000	38,002,400	16,524,000	15,746,400	17,107,200
Slow freight	158,630,400	154,548,000	155,908,800	262,440,000	259,912,800	268,272,000	306,957,600	293,544,000	303,652,800
Miscellaneous	5,054,400	5,248,800	4,860,000	29,160,000	34,214,400	36,352,800	35,380,800	35,769,600	35,769,600
Total receipts	294,904,800	283,180,800	286,740,000	514,188,000	522,936,000	537,321,600	492,609,600	478,418,400	491,054,400
Working expenses	160,185,600	159,408,000	157,075,200	317,649,600	331,257,600	333,007,200	307,152,000	312,789,600	312,789,600
Net earnings	134,719,200	123,832,800	129,664,800	196,538,400	191,678,400	204,314,400	185,457,600	165,628,800	178,264,800
Capital cost	3,196,324,800	3,254,061,600	3,319,768,800	5,771,736,000	5,866,992,000	5,972,940,000	3,098,152,800	3,190,687,200	3,270,002,400
Interest on capital, per cent.	4.21	3.81	3.91	3.41	3.27	3.42	6.00	5.20	5.46
Earnings per mile	12,543	11,950	12,013	23,590	23,838	24,309	15,955	15,173	15,265

*Year ending March 31.
†Including approximately $5,151,600 earned for carrying mails, on the English lines.

Country.	Year.	Population—Millions of inhabitants.	Population—Annual increase.	Production of coal—Millions of tons.	Production of coal—Annual increase.
France	1895	38.4	0.2 p. c.	28	2.4 p. c.
	1902	39		32.3*	
England	1895	39	1.1 p. c.	192	2.6 p. c.
	1902	42		230	
Germany	1895	52.3	1.5 p. c.	79	4.3 p. c.
	1902	58		107	

*Figure for 1901, taken for purposes of comparison, as more normal than that of 1902, in which there were strikes of exceptional importance.

The small increase of population (in France) is a point to which too much attention cannot be paid, when considering the course of railroad receipts in the past and in the future, just as when considering that of foreign technical publications recognize that we lead the way, and that the progress made during the last few years has been enormous; on the other hand, as far as provident funds and retiring pensions are concerned, our railroad employees are much better off than those of any other country, and than any other large class of salaried employees, whether in France or elsewhere. Whereas however in England and in Germany, the annual percentage increase of the working expenses during the last seven years has exceeded that of the receipts by about one-half or one-third, and has amounted on the average to 5 and 5.3 per cent., in France it has only been 2.4 per cent., exceeding the increase of the receipts by less than one-tenth. Neither the German authorities, nor the independent English companies, have made such efforts to reduce expenditure as our guaranteed companies, and this shows well that the financial arrangements under which the latter work are far from making the results of their working indifferent to them. The ratio of expenses to receipts, the working coefficient, remains 55 per cent. with us, whereas it amounts to 62 and 64 per cent. with our two great neighbors, who have a greater train mileage and tariffs at least as high, and cheaper coal and materials required for maintenance. Moreover, in Germany salaries are lower and the country is flatter, and all these are causes which should contribute to reduce this coefficient to a materially lower figure than it attains with us.

The comparatively moderate increase in the expenses explains how it is that although the increase in our earnings has been the smallest, since 1895, that in our net profit has been the greatest: 2 per cent. on the average, as compared with 1.3 per cent. in England and 1.6 per cent. in Germany.

In the case of capital expenditure, just as in that of working expenditure, it is in France that there has been the least increase. In the whole of Western Europe, the constant increase in the capital of railroads has to do not so much with the construction of new lines as with the extension of stations and of installations of all kinds, and with the increase of the rolling stock, made necessary by the development of the traffic. During the period we are considering, the extent of the new lines added to the German system (590 miles per year) was three times that added in France and the absolute development of the traffic nearly amounted to twice ours. It is, therefore, not surprising that the increase of capital was $71,150,400 per year, whereas with us it only amounted to $46,461,600. These latter figures would even seem excessive, were it not for the considerable (rather than productive) expenditure incurred in connection with the Paris exhibition. In England, the average capital increase has been $151,243,200 per year, an absolutely disproportionate figure if it is compared with the extension of the system, which has only amounted to 137 miles per year, and with that of the traffic, which corresponds to an annual increase in the gross earnings of $14,580,000. The high cost of the land required for extending the stations and duplicating the tracks in urban and suburban districts, the extension of subsidiary undertakings such as hotels, docks, ships, etc., explain to some extent the disproportion. It is, nevertheless, difficult to believe that there is not great waste somewhere; experts explain it by the requirements of the Board of Trade, by the uneconomic habits of English engineers, and also by the necessity for competition, which exists in organizing the services in England; although agreements have been made as to the fixing of equal rates by the different companies accommodating the same traffic, this competition frequently leads to the unnecessary duplication of installations and of services.

The result of all these different factors is that the ratio of net profit to capital expenditure has increased a little with us, whereas it has slightly decreased in England and Germany. According to the statistics, the net profit on the capital expended amounted, in 1902, to 3.91 per cent. in France, 3.41 per cent. in England, and 5.46 per cent. in Germany. But in order to have really comparable figures, we must add to the net profits made in France by the railroad managements the state taxes raised from the public and which do not show in the accounts, namely, the tax on passengers and

luggage, which yielded, on the main railroads, $12,052,800 in 1902, and the stamp duty on the receipts, which yielded $7,387,200. This taxation, which forms an extra toll by which the state profits, remunerates a good part of the capital it supplied for the construction of railroads, and raises to 4.50 per cent. the total remuneration of the whole of the capital. Nothing similar exists in Germany. In England, the only special transport tax is the passenger tax, which applies to passengers of the two upper classes only; it is included in the receipts and expenses of the companies, and yields the insignificant amount of $1,749,600 per year.

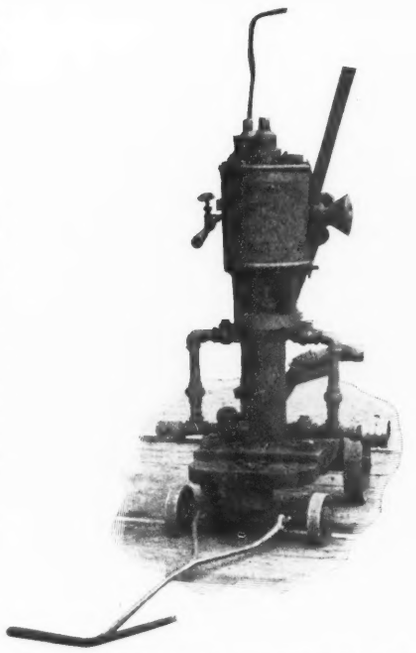
As we have frequently pointed out, the expenditure amounts to the enormous figure of $269,049 (including, it is true, receipts and capital of subsidiary undertakings) and this explains why the average return on capital is so low.

Shop Notes.

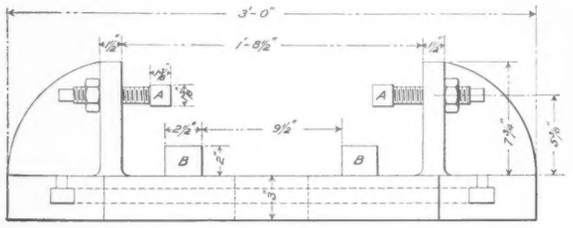
SAGINAW SHOPS OF THE PERE MARQUETTE.

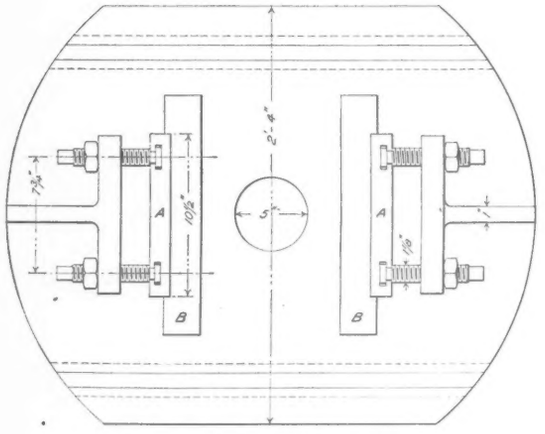
At the present time the shops of the Pere Marquette are in a transition state and the road is somewhat hampered by the lack of suitable facilities for the repairing of the heavy locomotives that are used for hauling through freight between Ludington and Detroit. Modern shops are in course of construction at St. Thomas, Ont., and at Grand Rapids, Mich., and it is expected that those will be ready for occupancy and operation very soon, after which the Saginaw shops will be somewhat relieved of the heavy work they are now called upon to do. Meanwhile about 11 engines a month are being turned out with general repairs.

These shops were built a little more than 20 years ago, when the Flint & Pere Marquette had about 60 engines.

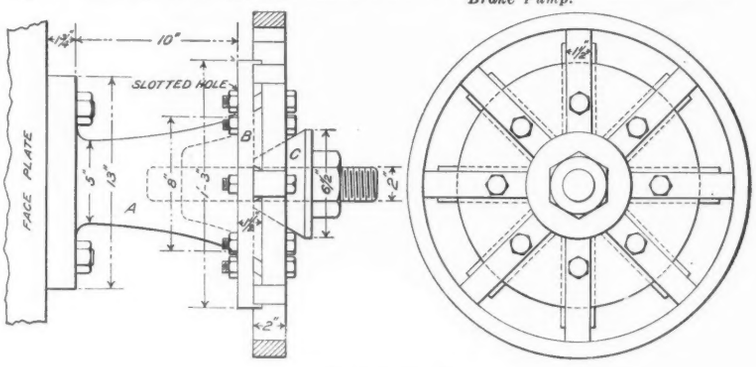


Boiler Testing Pump made from Westinghouse Air Brake Pump.

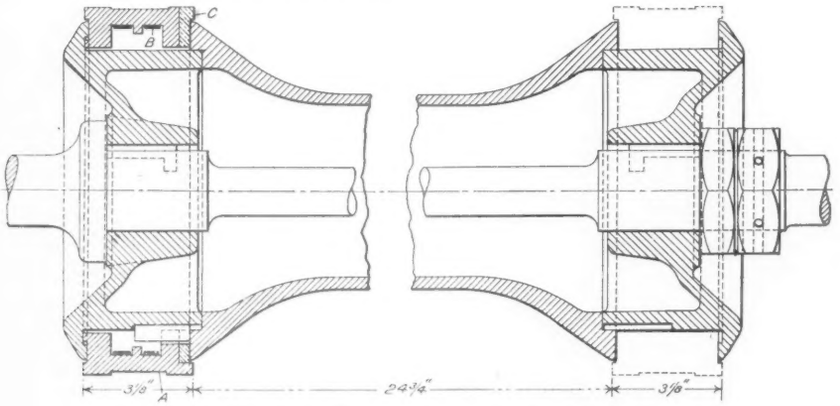




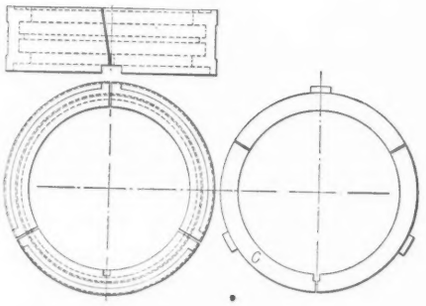
Driving-Box Chuck.



Piston Ring Chuck.



Piston Valve Fitted with the Royce Packing Ring.



Royce's Valve Packing Ring; Pere Marquette Shops.

Saginaw Shops of the Pere Marquette.

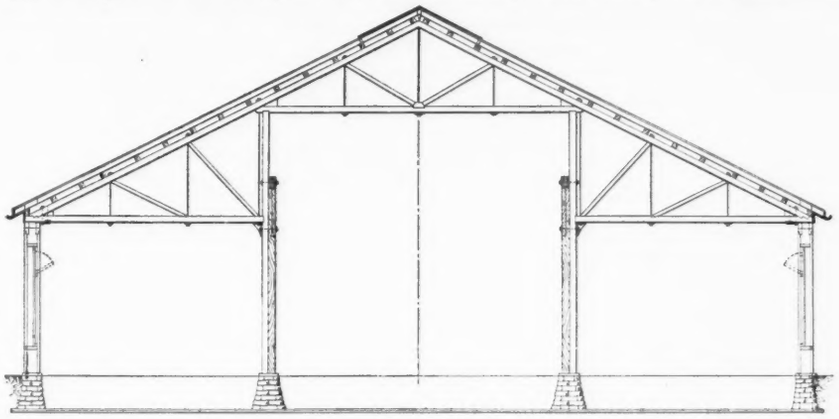
high proportion of profit to capital in Germany, is due to the facility with which railroads can be built in the vast plains of Northern Germany, and by the abundance of traffic, which results from the density of the population and the development of the great industries. Whereas in France, the average cost of the lines amounts to $137,649 per mile, and their gross receipts to $12,014 per mile ($12,825 per mile, taxes included), the average cost in Germany is only $100,111 per mile, and the gross receipts amount to $15,265 per mile. In England, the gross receipts amount to $24,310 per mile, but the capital

The main machine shop is a brick building 100 ft. wide and 285 ft. long, of which 90 ft. at one end is occupied by the boiler shop. The plan of the building is one that can scarcely be improved upon for a small road having comparatively a few engines to repair. Although the roof is unbroken the floor space is divided into three parts. The central span of 40 ft. is served by a traveling crane that covers the heavy machine tools, which are set out on one side, as well as the ends of the pit tracks so that it is available for lifting off cabs and doing work of that class at the rear of the engine. The space outside this central span on one side forms a bay filled with machine tools of a lighter sort, driven by a line shaft, taking power from an engine in the boiler shop. The opposite bay is used for erecting and has ten pits for the accommodation of the locomotives. These are served by an outside transfer table. The boiler shop is separated from the main shop by a brick wall rising to the roof and is also served by a traveling crane of ten tons capacity. This crane is home made and of an exceedingly simple construction, as shown by the engraving. It consists of four pieces of 5 in. x 8 in. pine, long enough

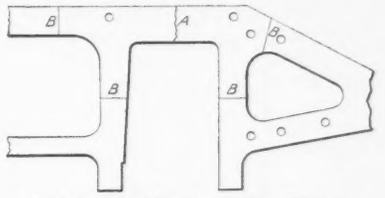
to form the framing, and these are trussed by 1 in. rods, as shown in the illustration. The wooden members carry short ties upon which rails are laid, and on these there is a carriage that can be moved to and fro by a chain connection from the floor. The carriage carries two chain hoists of different capacities, so that the one best adapted to the work to be done may be used.

The box chain hoists are used, and these, too, are worked from the floor by a light chain running over wheels keyed to the hoist shafts. There are two of these hoists; one of four and the other of six tons capacity. This arrangement makes it possible to lift and carry up to the full capacity of the crane and at the same time secure a more rapid raising of the load than would be possible were a single hoist of ten tons capacity used. The whole crane is made to travel by a chain and gear wheel from the floor. Such a crane is, of course, slow in action, but it possesses the advantage of being low in first cost, economical in operation, and absolutely costless in maintenance. The speed of the work is, naturally, less than that of the modern power crane, but one man can move the whole at a speed of 75 ft. per minute when it is moderately loaded, while three men can maintain the same rate when it is carrying the maximum of 10 tons.

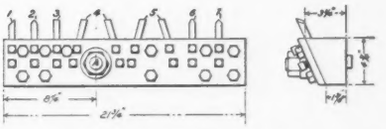
Of course in shops of this character there are a few handy tools in current use that might well be utilized elsewhere. Among these is a boiler testing pump which is illustrated in the accompanying engraving. It is made of the steam cylinder of an 8 in. Westinghouse air pump, with its piston rod attached to the plunger of a pump. By this means, the final filling of the boiler can be done and any pressure applied that may be desired. As will be seen from the engraving the device is mounted on wheels and can be readily moved from point to point.



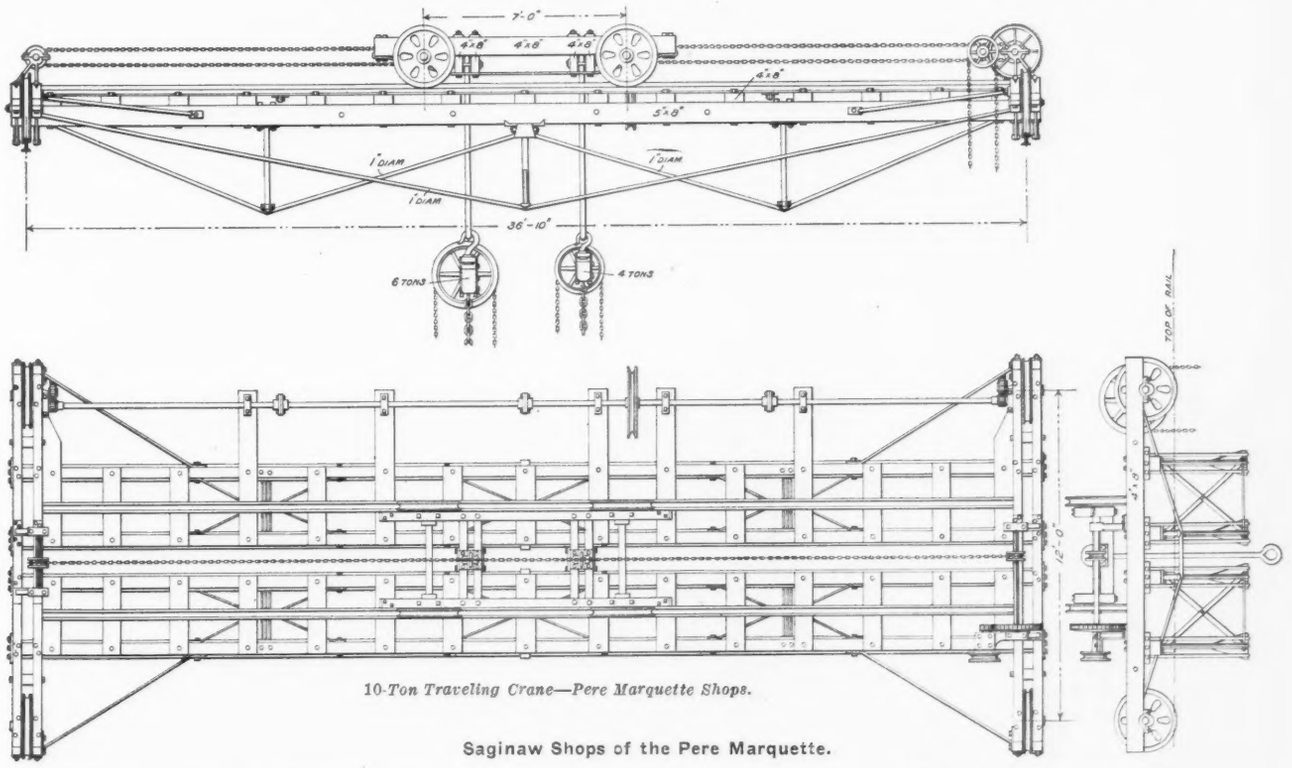
Cross-Section of Machine Shop.



Method of Welding Locomotive Frames.



Piston Packing Tool Holder.



10-Ton Traveling Crane—Pere Marquette Shops.

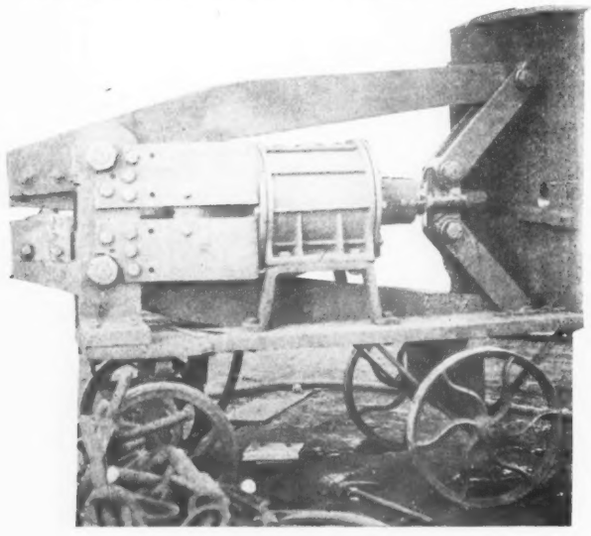
Saginaw Shops of the Pere Marquette.

In shops of limited capacity that are overworked, short cuts in the performance of work must be the rule, and among these short cuts is the method employed for the finishing of driving boxes. All of the boxes for an engine are first bolted to angle chucks on a planer and planed to exactly the same size and at the same time for the wedges. They are then taken to the boring mill and bored. During this latter operation they are held by the special chuck shown in the accompanying engraving. It consists of a heavy bed plate, slotted for the heads of holding down bolts, and fitted with two heavy angles for the clamping screws. These screws, of which there are two on each side, carry the bars A A, that serve as the jaws of the chucks. In operation a box is laid upon the parallel strips B B, which are fastened to the base, and is clamped in place by the jaws A A. It is then held down by bolts and straps in the usual way. After one box has been set and bored, the others belonging to the same engine can be adjusted and finished without any delay, as it is simply necessary to slack back one of the jaws. It is the practice of the road to plane all the box surfaces straight and not allow for any lateral rock on the wedges. Careful observation has shown that upon this road, at least, there is no difference in the wear and tear and breakage of wedges on engines equipped with straight flange and rocking boxes.

Another handy combination of tools is that used for the turning of piston ring packing. Formerly the Dunbar packing was used extensively if not exclusively in these shops; but it has been entirely superseded by the common split ring. Unlike many other shops, the practice here is not to cast the packing in one long ring or cylinder, but each ring is cast separately and finished by itself. This involves the use of a special chuck and special tool holder. The chuck, as shown in the illustration, consists of a

stiff base A bolted to the face plate of a lathe. The outer flange B is circular and scored with eight dove-tailed grooves carrying as many dogs that are partially held and may, if necessary, be clamped to the flange. These are set out by a conical slide C, that is forced in by a nut turning on a stud, that is fastened to the body of the chuck. The setting of the ring consists in simply slipping it over the dogs and screwing in the nut.

The tools for doing all of the work on the ring are held in a single holder, shown in the illustration. This consists of a casting 21¾ in. long with grooves in the upper surface for the reception of the tools, over which a cap is placed and held down by a number of ⅝ in. tap bolts. The tools themselves are held firmly by ½ in. set screws in the cover. Taking these tools from left to right, that marked 1 at the end serves to cut the scale and slightly bevel the corners at the start. No. 2 is the roughing tool for the outside face. No. 3 is a finishing tool for the same. The two tools, No. 4, are the roughing tools for the sides, and the two No. 5, serve for the finishing being set so as to cut the ring to the exact width that it should be. No. 6 is used to turn a light oil or water packing groove in the face, and No. 7 to slightly chamfer the corners so that there will not be a sharp edge to cut the face of the cylinder. The holder itself is fastened to the carriage by a stud and nut A.



Portable Scrap Shears—Michigan Central.

Closely related to the piston packing rings are those of the valves, which are largely of the piston type. A great deal of trouble has been experienced by the wear of the bridges and the rings catching in the ports and breaking; at the same time fracturing the followers and the spool. In order to obviate this difficulty a new form of ring has been designed by Mr. H. G. Royce, the foreman of the machine shop. Instead of the narrow rings ordinarily used there is a single broad one 3⅛ in. wide of the section shown. This heavy ring is turned $^{1}/_{32}$ in. larger than the bore of the steam chest, and then cut $^{1}/_{64}$ in. It is split into three sections as shown, and these are held out against the bore by light springs B placed in the cavity beneath. The springs are just strong enough to exert a light pressure and carry the weight of the rings. A brass plate C, with projecting lugs to prevent it from turning, serves to cover the openings between the sections and prevent leakage of steam. The whole is slipped on over the follower, which is held in place against the spool by the nuts on the valve stem as shown in the illustration of the valve. Experience with this type of valve ring has been of the most favorable character and no trouble has been experienced in any way from binding, leakage or breaking. They have been put on old engines to replace broken rings and have worked satisfactorily from the start. It is not known how long they will last as none have worn out yet, though they have been in constant service in old steam chests for 11 months.

It will be remembered that in the *Railroad Gazette* May 15, 1903, a description was published of the method used by the Baltimore & Ohio for welding broken locomotive frames in place. This class of work was criticized in Saginaw on the ground that it would be impossible to make a thorough weld through the whole body of the metal by butting the two parts together and depending on screws and side hammering for effecting the union. The method used there is to take down the frame and put in a long scarf weld. In some cases where the break has occurred over the journal box, the whole top is cut out and a new piece put in. This is shown in the accompanying sketch, where the ragged line A indicates the straight break and the straight line B the limits of the new piece that has been set in. In support of this method of welding, it is claimed that in 25 years they have never had a mended frame break in the weld.

Grinding is extensively used for finishing and repairing certain parts of the engines. An old planer has been converted into a very efficient surface grinder and is used on long parts. Heavy brackets with bearings have been bolted to the top of the frame, and in them there is carried a large drum extending the whole width of the machine. The emery wheel is carried in a carriage on the cross rail and is given the usual cross and vertical feeds. One of the lathes has also been fitted with a grinding attachment for truing link saddle pins and similar parts that are case-hardened and likely to be warped or injured by heating and annealing. The saddle is bolted to the face plate of the lathe and a small emery wheel is carried on the carriage. The driving drum overhead is made of an old piece of gaspipe, into which heads have been forced and keyed on a light countershaft.

One of the shortest cuts in the shop is the method of planing rod keys. The ordinary methods of shaping and finishing consumed so much time that the shop could not keep up with the demands of the work. So now two cuts on a side serve for the finishing of a rod key. These two cuts taken are 3 in. wide each and cover the whole surface of the key at once. Naturally the face is not left in a very smooth or highly polished condition, especially as the metal is worked dry, but as the keys and rods are painted, it is argued that the roughness does not show and the keys serve their purpose just as well when thus worked up in three minutes as though as many hours had been used in their shaping.

One of the novel features of the management of the locomotive department of the Pere Marquette is that no accounts are kept. All of the accounting is done at the storehouse. The general storekeeper has charge of all of this work, even to the time of the men in the shops, the locomotive mileage, cost of coaling engines and services of engine crews. Once a month a statement of mileage and expenses is made to the master mechanic and in the meantime the department is freed of all care in this direction. There seems to be no reason except a claimed economy of accounting for the separation of the department from its own bookkeeping.

As already stated the shops are at present overtaxed, but it is thought that they will be greatly relieved as soon as the Grand Rapids and St. Thomas shops are opened.

DETROIT SHOPS OF THE MICHIGAN CENTRAL.

These shops are devoted almost exclusively to car repairs, very little construction work being done. The original buildings were erected in 1881, on grounds that allowed ample room for expansion. In their present appearance the item that impresses one most forcibly and at once is the extreme neatness and cleanliness of the premises. Except where workmen are actually engaged in tearing down old cars there is no litter whatever. This cleanliness is especially noticeable in the lumber yard where the stocks are kept under the supervision of the general storekeeper. The car department itself carries no stock ahead but draws in accordance with its requirements on the storekeeper on a regular requisition. The stock in the yard includes everything that will be needed, and a great deal of it is received dressed and ready for use. This is done on account of the high freight charges from the south and

Lumber Yard—Michigan Central.

west, so that it has been found to be cheaper to pay for the dressing than for the extra freight required on the rough lumber. At present the large material that is used is southern pine, though it is not considered to be as good or as durable as the Douglass fir, considerable quantities of which have been used. But the lower first cost and the difference in freight causes the preference to be given to it.

The extensive yards about the shops are piped for compressed air, which is supplied by two compressors in the planing mill engine room. Air is therefore used for a great variety of services, some of which are unique and worthy of imitation.

Among the appliances connected with the shops is a drop testing machine, made in

FIG. 1

Cutter for Draw-bar Yoke Rivets.

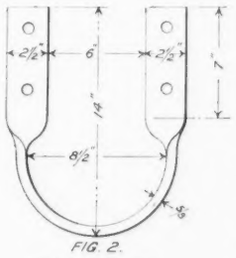


FIG. 2.

Brake Staff Step Bulldozer Work.

Michigan Central Shops.

accordance with the recommended practice of the Master Car Builders' Association. It stands in the yard convenient to the storage space allotted to wheels, axles and couplers, and has the capacity called for: that is the tup weighs 1,640 lbs. and the height of the drop can be varied up to 43 ft. The machine is used for a number of purposes, among them being the cutting off of the rivet heads holding the yokes of old drawbars, as will be noted again later, by which a great deal of time and labor is saved. The tup is raised by means of an air cylinder, the motion of which is multiplied through a wire rope.

The method of loading mounted wheels and axles is peculiar and convenient. A cylinder about 42 in. in diameter with an 8 in. piston is sunk between the rails of the loading track, and is adjusted so that when the piston is at its lowest position the top of the piston-rod is just flush with the planking. A yoke having a 2 in. stem is dropped into a hole in the end of the piston rod and serves to lift the wheels and axle by taking hold of the center of the latter. When in operation a flat car is placed on either side of the lift and skids are placed upon and between them. The wheels are then raised so as to be above the skids, are swung through a quarter circle and then lowered to the skids over which they are rolled to the cars for shipment. This apparatus enables a gang of a half dozen men to load a flat car with 36 in. steel-tired wheels as rapidly as they can roll the wheels to the hoist.

In connection with the handling of wheels there is a handy little tumble jack used in the wheel storage yard. It consists of a V hinged to a base that sets into a socket in the track. When out of use the V drops down and is out of the way of passing wheels and axles and lorrey cars. If it is to be used it is propped with an eye bolt and inclined towards the wheels to be turned. The latter are run against the V, which catches the center of the axle and is carried to an upright position by the momentum where it remains. This raises the wheels clear of the rails and they can then be swung round at right angles and run off on the storage tracks. It saves a great deal of work in the handling of wheels and effects a very material economy of time.

Another application of air is on a pair of shears in the scrap yard. As will be seen from the illustration, the device is mounted on wheels and can be taken to the work. A large cylinder attached to a toggle joint, that adds to the leverage of the arms, gives the machine a capacity for shearing 1½ in. round bars.

Another shearing device is a clever arrangement of the wheel testing drop for cutting off the rivets holding yokes to drawbars. An anvil is so arranged that a cutter like that shown in Fig. 1, can be set down on the rivet heads and the whole wedged so that it cannot slip horizontally. One or two blows of the drop serves to shear the rivets and leaves the yoke or castings to be used again as conditions may warrant.

Bulldozer work is always interesting and the shapes that can be formed on this machine are almost innumerable. A shape that gave some trouble at first is that of the standard brake staff step shown in Fig. 2. The method finally adopted was to lay the hot bar in flat and, by catching it on edges at the ends, put in the twists. It is then slipped on to another part of the former and bent at the bottom. The whole is done at one heat and with two strokes of the machine.

The cleaning of car cushions is done by means of the French machine, which is a combination of beater and compressed air. The cushions are fed into the machine very rapidly and the whole of the work is done automatically in a manner that leaves the plush thoroughly clean and ready for the dyer.

A type of stencil for freight car work is in use that is not common, but which is cheap and easily made. The stencils are cut out of heavy paper in the usual way, except that no bars are required to support encircled portions. The paper thus prepared is pasted to a fine wire netting like mosquito netting and the latter may be mounted in a suitable frame. The glue used for fastening the paper stencil to the gage is made of glue prepared in the ordinary way to which, while it is hot, three ounces of glycerine is added and stirred in to the quart. In the preparation of the glue care must be taken that it is neither too heavy nor too thin, the proper consistency being best determined by trial and experience. Stencils thus prepared are very strong and durable and have all of the flexibility of the paper and can be made to lay close to the work, while the paint is readily applied through the interstices of the netting which leaves no mark upon the work. The regular freight car painting is done with long handled broad brushes from the ground and so rapidly and economically that there has never been any inducement to attempt spray work which now seems to be becoming a thing of the past.

The bulk of the work at Detroit consists of freight car repairs and that is done in the open, in a long shed and in a roundhouse. The shed has three tracks and can accommodate 18 cars at once. This is regarded as more convenient than the roundhouse in that the latter involves a great deal of turn-table work, not only in handling the cars themselves but in taking supplies to the men and the removal of waste. The turn-table itself is handled by men, and the cars are moved in and out by means of a rope and snatch blocks, worked from a winch on a jib crane located on one side of the pit. This crane is worked by an old steam engine that had been rescued from the scrap, and which is driven by air so that no special attendance is required.

At one end of the yard a special place is set aside for the destruction of old cars. Here large numbers of the old equipment of the lighter cars of 30,000 or 40,000 lbs. capacity are burned every year. The wood in these cars is not worth the expense of tearing them to pieces, so a rope rove through a snatch block is thrown around them and a locomotive is used to haul them off the track to the vacant space where they are burned.

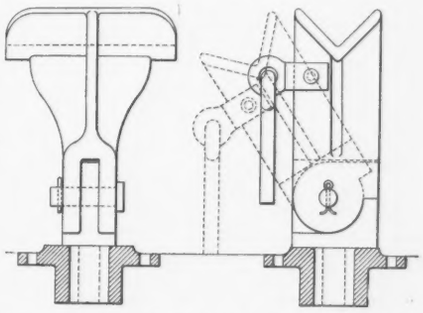
The steel car problem has not affected the car department very seriously as yet, as the road only owns a few, and there are the works of the American Car & Foundry Co. in Detroit that are available and which are called upon to make any extensive repairs to steel cars that may be required.

At the shops themselves the facilities for this class of work are still rather meagre. They consist of a piece of track set aside for the purpose with a number of strong eyes set in the ground on either side. These eyes are used for holding the car body down when it is desired to bend it by jacking. For example if a side sill is bent down in the middle the ends of the car are clamped down by means of the eyes, the bent portion is heated with portable oil burners and the center jacked up. Other damaged portions can also be repaired in a similar manner. The subject is, however, under investigation with the intention of establishing suitable facilities for making this class of repairs.

Piecework has been very generally adopted for the work of the shops. In all there are about eight thousand schedule prices, which have been based on timed records taken from the performance of the several operations. Under the schedule the men are able to make considerably better wages than they could possibly do under day work rating, while the increased output of the shops makes it a profitable arrangement for the company.

ROCHESTER SHOPS OF THE B., R. & P.

The main shops of the company have been moved from Rochester to Dubois and the old shops at the former place are now used only for light repairs. Extensive improvements are, however, being made in the roundhouse accommodations. The old roundhouse at this point has been torn down and in its place a new building is in the course of erection. This will be fitted with a 75 ft. turntable driven by electricity and will have 14 stalls each 80 ft. long, so that there will be room to take care of the largest locomotives and still leave ample space at the head for the roundhouse work. The rails and jacking planks of the pits are to be carried on



Tumble Jack for Swinging Wheels to Storage Track—Detroit Shops.

heavy concrete walls, and the bottoms will be of the same material. The floors are also to be of concrete, laid so as to be flush with the top of the rail. Two of the pits are to be arranged for the removal of wheels with heavy drop jacks and a car running on rails in a transverse pit. There will be three of these jacks; one at each of the pits and one between.

The house will be heated with hot air. The building will be divided into two sections and the hot air will be carried around the outer side by a large conduit having a concrete floor and sides with a brick roof. From this conduit concrete branches are led off between every other pit and this, in turn, is divided so that the air is delivered into the pit through 12 in. openings at the back

end which will be under the front end of the engine and about half way down its length. Dampers will, of course, be provided so that the air delivery can be controlled and sent to those pits where it will be needed.

Among the shop practices at Rochester attention may be called to the method of shrinking car wheel tires on old centers. The tire is heated by a ring burner fed with a combined air and gas jet, and when this part of the work has been completed and the tire is in place, the gas is shut off and a jet of air allowed to play against it. This hastens the cooling somewhat but not to the same extent as the usual stream of water. It is thought that with this system there is less danger of uneven contraction and the development of cracks than where water is used.

In the washing out of boilers hot water is used under ordinary conditions. This water is obtained from a heater and is pumped direct from it into the boiler. If, however, the engine has been standing for some time and has become perfectly cold, then cold water is used for washing out. But, even then, it is recognized that it does not have the same softening and loosening effect upon the mud and scale and is not as efficient as hot water would be.

Block Signaling on Lines of Light Traffic.

Most of the discussions on block signaling which have been brought to public attention since last year's epidemic of disasters and the consequent proposals concerning Governmental regulation have been noticeable for their onesidedness. The favorite view has been that a four-track railroad with a complete automatic signal system was the proper remedy for collisions, and the only proper one. It is true that such an ideal ought to be aimed at. It may be admitted that a double track will always be safer, probably, than a single track. Having a separate pair of tracks for slow trains unquestionably promotes economy and simplicity, where the traffic is heavy enough. Automatic signals are based on the ideal theory, and must surely supplant the non-automatic, as traffic increases, on the great majority of the heavier American lines. But why should we lose ourselves in pleasant air castles based on the expected ideals of the future and ignore the problems of the present day? A condition, not a theory, confronts us. The immediate question with managing officers is, how to insure trains against collision on lines where there is no money to build a second track—to say nothing of a third and fourth—or even to provide automatic signals on the one existing track. And on thousands of miles this question has been met and quite wisely settled, as will be seen by the statements printed in the *Railroad Gazette* of January 27. The managers of these roads saw that the adoption of the space interval principle must not be allowed to wait until the most perfect appliances could be supplied, and so they adopted the principle with certain modifications. This employment of methods admittedly imperfect, ought perhaps to be classed as a compromise with principle; and it is to be acknowledged that the term compromise often suggests something discreditable; but increased safety of life and limb with a marked decrease in the expense for clearing wrecks constitute too palpable an improvement to be ignored, whatever may befall our theories; and the *Railroad Gazette* has therefore made prominent the practice of numerous roads on which this imperfect block-signaling has been most extensively introduced. As a matter of fact our theories are not damaged; quite the contrary, so far as methods and results are concerned. The theory that we must have complete block signaling or none at all has only an academic interest. The theory that has actually been put in use is the old one of dependence on the flag-lantern-torpedo-fusee combination, and that is immeasurably "improved" by being relegated to the scrap heap and by having the space-interval theory put in its place—even if it be a much modified space-interval theory.

We have brought up this subject at this time for the purpose of describing an example or two of the less-than-perfect signaling here referred to. The examples are found on the Chesapeake & Ohio. We take that road as a typical one, not because it falls farther short of perfection than others, but because it was one of the earliest to make extensive use of the block system on lines which by most managers would have been classed (10 or 15 years ago) as too thin to be proper fields for the employment of space interval regulations. And as for the degree of laxity allowed, it is to be observed that quite liberal modifications of block signal rules are to be found on roads where the traffic is heavy and where the block system has been in use many years. The "thin" lines have no monopoly in this respect.

The line of the Chesapeake & Ohio from Richmond to Gordonsville, 75 miles long, single track, is one of light traffic, and the block system is worked on it at the minimum expense. Not all of the strict Board of Trade requirements which would be insisted on in England are enforced, but the two main elements of the space interval principle are provided for in a way that has proved satisfactory to the officers of the company; these are (1) the absolute blocking of all trains against others running in the same direction, except in emergencies, and (2) the blocking of all trains against others running in the opposite direction subject (a) to a station limit rule and (b) subject to exception in cases where special orders are given by the despatcher, a separate order for each case. The emergencies and exceptions are rare.

The most common emergency is the running of additional passenger trains at night; but this is generally provided for by having the day operators keep the day offices open extra hours, for which they are allowed extra pay; so that there is no emergency, after all.

For trains running toward each other the first condition (a) is that there is only one signal at a station, as shown in Fig. 1.

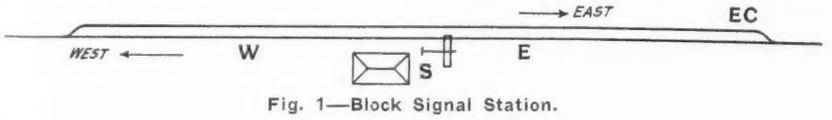


Fig. 1—Block Signal Station.

This signal is opposite the telegraph office, which is the station ticket office; and trains are allowed to run partly past it before stopping. An eastbound passenger train will be stopped with its engine at E. To guard against a collision between this train and a westbound train between the signal (S) and E dependence is placed on the time-table rules and despatchers' orders, the same as though no block system were in force. At all regular meeting points for regular trains, and at meeting points made by despatcher's order, unless there is a mistake in giving or executing the order, the inferior train will enter the side track at the first switch, thus leaving (in the case of an eastbound train) the space between E and E C—from 300 ft. to 1,200 ft.—as leeway for possible overrunning. To run trains with safety by the block system alone, throwing aside the time-table and the rules of superiority, it would be necessary to require all eastbound trains to run with speed under control from W to the signal, and all westbound to run under control from E to the signal—(or, to simplify the rule, to run under control between the switches). The present plan has, however, proved so satisfactory that no such requirement has been deemed necessary. By doing without it much time is saved.

The second condition, in blocking opposing trains, is that, with long block sections, as is necessary on a line of light traffic, trains must sometimes meet at sidings between block stations. This is allowed, when necessary, but only on a despatcher's order, which must be a positive meeting order. This eliminates all chance of danger from errors in calculating time; and as such meeting orders invariably refer to only one train in each direction the dangers arising from having too many operations mentioned in a single order are also done away with. The order is usually received by the train at the last block station before reaching the meeting point, and in addition to the meeting order, the engineman receives a green card; and the signal is not pulled off. This green-card arrangement is the regular way of giving permissive block signals on the C. & O.

The Richmond-Gordonsville single track line is 74.7 miles long and has block stations at

	Miles.		Miles.
A R (D. N.) ...	0.0	B D (D. N.). ..	38.7
A B	8.5	F H	48.9
H A	17.0	S V	55.0
H N (D. N.). ..	26.1	C U	60.8
X	34.0	G (D. N.)	74.7

At night only the offices marked "D N" are open, making the length of the block sections 26.1 miles, 12.6 miles and 36 miles. These long blocks are practicable because the only night trains have no meeting points on this section. The number of regular trains over this section is 12 a day, and usually there are no extras. The regulars are two first class (passenger), two second class (passenger), and two third class westward, and the same eastward. There are six regular meetings.

All there is to be said about the cost is that the same apparatus and the same number of men would be employed if no blocking were done. Possibly some road of similar character not using block signals would require the station agents to give less constant attention to their duties and so would feel warranted in paying them slightly smaller salaries; but the Chesapeake & Ohio pays substantially the same rates as those paid by other roads in the same territory.

Indeed the reply of the officers of the Chesapeake & Ohio to questions about cost are of the same tenor, whatever part of the lines be considered, whether the busiest parts of the main line, where the traffic is as heavy as can be handled without an additional main track, or lines of light traffic like that described above. The space interval was adopted on the main line a dozen years ago and its extension has been made to keep pace with the expansion of traffic. It more than keeps pace, as lines doing even less business than that named above are block signaled.

The Greenbrier division, 96 miles long, has only three trains each way daily, yet the trains are systematically blocked except for the modifications noted below. There are two local passenger trains and one local freight. The agents (operators) are required to attend as closely to their offices as at any block station, though they are allowed 45 minutes (or more when necessary) as a meal hour. Whenever the despatcher requires an agent to stay through the meal hour extra

pay is allowed. The regular salary of most of the agents is $50 a month. No night operators are employed. The block offices on this division are as follows:

	Miles.		Miles.
W D	0.0	M O	56.1
N H	1.8	K C	71.1
H Y	14.1	C S	80.7
R N	24.8	C N	88.1
S B	45.8	D R	95.6

The accompanying time-table is a reduced fac-simile of the latest at hand for this division. It will be seen that the up and down passenger trains meet each other, both morning and afternoon, at a non-telegraph station. The despatcher gives these trains regular meeting orders every day and the engineman of each also receives a caution card, after the manner above mentioned. Freight train 145, meeting passenger train 142 at a non-telegraph station, does not receive a meeting order. If the passenger train should be delayed, the freight would receive an order giving it time over the passenger train, and if the new meeting point is a non-telegraph station the engineman of the passenger train will receive a caution card. Train 145 follows train 141 from Cass on a caution card. Freight trains 145 and 146 usually receive a meeting order every day, although when on time they meet at a telegraph station. This is to avoid loss of time if the inferior should be a little late. Thus there are usually three meeting orders given each day on the division.

GREENBRIER DIVISION.

WESTWARD — EASTWARD

FOURTH CLASS.	SECOND CLASS.		Side Track—Capacity in feet.	Telegraph Offices.	TIME TABLE No. 75. In Effect Sunday, Nov. 13, 1904. STATIONS.	Distance from Roncevert.	SECOND CLASS.		FOURTH CLASS.
145	143	141					142	144	146
Lv. Daily ex. Sun.	Lv. Daily ex. Sun.	Lv. Daily.					Ar. Daily ex. Sun.	Ar. Daily.	Ar. Daily ex. Sun
.....	1 30pm	.....	370	.....	BARTOW	100 9	11 45am	.....	.....
					2.5				
5 00am	s 1 45	6 00am	1773	DR	W....Durbin	98 4	s11 30	7 15pm	5 10pm
					3.5				
5 20	f 1 54	f 6 10	925	.....	Boyer	94.9	f11 18	f 7 02	4 50
					3.9				
5 45	s 2 04	s 6 21	2275	CN	Hosterman	90.9	s11 08	s 6 50	4 25
					7.4				
6 40141	s 2 21	s 6 40145	4469	CS	Cass	83.5	s10 51	s 6 31	3 40
					3.8				
7 15	s 2 31	s 6 51	1565	.....	W....Stillington	79.7	s10 41	s 6 19	3 20
					5.8				
7 40	s 2 45140	s 7 08	1762	KC	Clover Lick	73.9	s10 25	s 6 01	2 45145
					8.8				
8 10	f 3 05	f 7 30	850	.....	Clawson	65.1	f10 05	f 5 39	1 10
					6.2				
9 00	s 3 20	s 7 46	5316	MO	W....Marlinton	58.9	s 9 50	s 5 23	12 10
					3.9				
9 39148	s 3 30	s 7 57	1720	.....	Buckeye	55.0	s 9 39145	s 5 12	11 20
					6.4				
10 50140	s 3 46	s 8 13	3116	SB	Seebert	48.6	s 9 23	s 4 56	10 50145
					7.3				
11 20	s 4 02	s 8 31	2100	.....	Beards	42.3	s 9 07	s 4 38	9 50
					6.5				
11 45	f 4 20144	f 8 50142	1700	.....	W...Droop Mountain	34.8	f 8 50142	f 4 20145	8 50142
					7.2				
12 40	s 4 38	s 9 07	5440	RN	Renick	27 6	s 8 33	s 4 03	8 12
					3.2				
1 00	s 4 47	s 9 16	1740	.....	Spring Creek	24 4	s 8 24	s 3 54	7 55
					7.5				
1 40	s 5 04	s 9 32	2700	HY	W....Anthony	16 9	s 8 08	s 3 38	7 20
					3.1				
2 00	f 5 12	f 9 39	2130	.....	Keister	13 8	f 8 01	f 3 31	7 00
					9 2				
2 50	s 5 33	s 9 58	3140	NH	North Caldwell	4 6	s 7 42	s 3 12	6 25
					1.8				
3 00pm	s 5 38	s10 03	800	WD	Whitcomb	2.8	s 7 36	s 3 06	6 10am
					2.8				
.....	5 45pm	10 10am	.....	BG	RONCEVERTE	0.0	7 30am	3 00pm	.....
Ar. Daily ex. Sun.	Ar. Daily ex. Sun.	Ar. Daily.					Lv. Daily ex. Sun.	Lv. Daily.	Lv. Daily ex .Sun.

s—regular stop. f—stop on signal W—water tank.

Time-Table of the Greenbrier Division of the Chesapeake & Ohio Railway.

The second-class trains are all passenger.

It will be seen that the only important question of cost on lines like those described is that which has to do with delays to trains. As will be obvious to the reader, this, on such a line as the Greenbrier division, is of no consequence whatever. As traffic increases—say to the volume which is moved over the main line of the Chesapeake & Ohio, or on the thousands of miles of main lines in the central west which are worked in substantially the same manner as the C. & O.—there is the question of delays to fast freight, and hindrances to passenger trains—both costly but not always measurable—and the direct cost of overtime pay to the men who run the delayed trains. With such a traffic there comes up a direct issue—expend $1,500 to $2,500 a mile for automatic signals and thus have shorter blocks, or go back to the weak and beggarly elements of the time-interval rule, flags, lanterns, torpedoes and fusees. If a manager consider only the immediate and direct cost he may perhaps be inclined to take the backward step—or to go so far in that direction as to allow a large amount of permissive blocking; but if he sets a proper value on his own peace of mind, and has educated his fellow officers to an appreciation of the fact that the block system is essential to their mental serenity, his step will be forward, not backward.

Proposed Specifications for Cast-Iron Wheels.

BY C. W. GENNET, JR.

The specifications for cast-iron wheels, adopted as Recommended Practice by the Master Car Builders' Association in 1904, are indefinitely worded in places and admit of misinterpretation. The following specifications have been prepared with the purpose of specifically defining the requirements of a satisfactory wheel and to provide for a method of testing wheels which will admit of no controversy or misinterpretation and which will be equally fair to maker and purchaser alike.

1. Wheels must be of the company's standard design as shown on drawings ———, which form a part of these specifications.

2. The chill used must have the inside profile as shown by the 1904 drawings of the M. C. B. wheel tread, and its inside diameter must must be the M. C. B. standard of 33½ in. measured at a point 2⅝ in. from the outside of the wheel tread. The thickness of the flange shall be regulated by the maximum and minimum flange thickness gages adopted by the M. C. B. Association.

3. All wheels must be taped with a standard M. C. B. design of wheel circumference tape, and the shrinkage or tape number of the wheel shall be plainly stenciled with white paint on one of its plates. The following numbers are to be used to represent the size:

No. 1. For wheels measuring ¼ in. small in circumference or 103.42 in.

No. 2. For wheels measuring ⅛ in. small in circumference or 103.545 in.

No. 3. For wheels of 33-in. normal diameter and of circumference 103.67 in.

No. 4. For wheels measuring ⅛ in. large in circumference or 103.795 in.

No. 5. For wheels measuring ¼ in. large in circumference or 103.92 in.

Wheels must not vary above or below the normal size more than here shown, and the same wheel must not have its diameter vary more than 1-16 in.

4. All wheels must be numbered consecutively in accordance with instructions from the railroad company, and no two wheels shall have the same number. Numbers made vacant by rejection or other causes shall not be filled.

5. All wheels shall have plainly cast on the outside plate the maker's name and place of manufacture, and on the inside plate shall have plainly cast the initials of the railroad company, the wheel number, its normal weight and the day, month and year when made.

6. Wheels shall not vary from the specified weight more than 2 per cent.

7. Previous to inspection, wheels shall be arranged in rows of the same shrinkage numbers, and for each 200 wheels or fraction thereof, which are ready for shipment, there shall be taken two wheels of each shrinkage or tape number represented in the lot, one of which shall be submitted to the drop test and the other to the thermal test described below. If the lot is made up of different casting dates the test wheels will be chosen so that the different dates will also be represented as far as possible.

8. *Drop Test.* The wheels shall be placed flange downward on an anvil block weighing not less than 1,700 lbs., set on rubble masonry, at least 2 ft. deep and having three supports not more than 5 in. wide to rest upon. It shall be struck centrally on the hub by a weight of 200 lbs., which must have a striking face at least 8 in. in diameter and perfectly flat. The wheel without breaking into two or more pieces, must be struck the number of blows by the weight falling from a free height as given in the following table, and when finally broken, it must show a depth of chill within the limits also shown.

Normal weight of wheel, 600 lbs., 650 lbs., 700 lbs.

Height of drop, 9 ft., 10 ft., 12 ft.

Number of blows, 10, 12, 12.

Depth of chill in the throat, ⅜ in. to 1 in.; 7-16 in. to 1 in.; ½ in. to 1 in.

Depth of chill in the tread, ½ in. to 1 in.; ½ in. to 1 in.; ½ in. to 1 in.

9. The wheel before and after breaking must show clean, soft, tough, gray iron; free from slag, shrinkage or blow holes, shifting cores or any indication of bad or irregular foundry practice. Mottling in the plates to within not more than one-half inch from the chaplets will be permitted. The clear white iron of the chill must shade into the gray iron without showing any appreciable line of demarcation, and the depth of chill will be regarded as that depth of clear white iron which shows no grain or spots of the gray. It must not vary more than ¼ in. in the same line in a wheel, nor must there be any tendency toward mottling or speckled iron to a depth of ¾ in. beyond this measurement of its depth. The tread must be free from deep and irregular wrinkles, slag, chill cracks, and sweat or beads in the throat, and swollen rims.

10. *Thermal Test.* The wheel of normal temperature must be laid flange down in the sand and a channelway 1½ in. wide and 4 in. deep must be molded with green sand around the wheel. The clean tread of the wheel will form one side of the channelway and the clean flange will form as much of the bottom as its width will cover. The channelway must then be filled to the top with molten cast-iron which must be taken from the big ladle and poured with as little delay as possible to permit of its transfer. The time of pouring must not exceed 15 seconds, and two minutes after pouring ceases the wheel must show no evidence of a crack that extends through or into the rim, flange or tread.

11. Should a wheel fail to withstand either the drop or thermal test, or if the conditions prescribed in Section 9 are not complied with, then all wheels represented by such test wheel will be rejected. The maker can, however, if he desires, offer to make a drop and a thermal test on wheels of the same shrinkage or tape number as that of the failed wheel but from each of the other casting dates represented, and if these re-tests stand, the lots so represented will be accepted.

12. Individual wheels will not be accepted which

(a) Do not conform to standard design and measurement.
(b) Are under or over weight.
(c) Have apparent physical defects of foundry practice.

13. Lots of 200 wheels or fraction thereof will not be accepted if the drop or thermal test wheel fails to meet the conditions prescribed in Sections 8, 9 and 10, except in cases of retests being made as prescribed in Section 11; no wheels will be accepted which bear the casting date and shrinkage number of any of the test wheels which have failed.

The present M. C. B. specifications are based on the assumption that there is no difference in quality between wheels cast on different dates and between wheels of different shrinkage sizes. This assumption does not seem justifiable, particularly to purchasers of small lots of wheels, who, by its application, are afforded little opportunity for protection against wheels of inferior quality. This proposed specification has for its foundation the possible difference of quality as shown by the shrinkage sizes of the wheels, irrespective of casting dates. This scheme has been previously suggested, but it is believed has never been practiced, although it would seem to be the best basis for making representative tests.

By the terms of the present M. C. B. specification the discrimination between dates and sizes is likewise entirely prohibited when it becomes ultimately necessary to make a rejection. This does not seem fair to either manufacturers or purchasers, and the procedure proposed above seeks to regulate this feature.

Any plan of selecting test wheels indiscriminately from lots of 100 is generally unsatisfactory to purchasers, for they have come to regard the production of a uniform quality from day to day as open to question. This suspicion is, however, not borne out entirely by practice, for it seems true that when any defect occurs in a day's cast the same may be properly traced to a particular cause, the detrimental effects of which are limited to certain shrinkage sizes. The other method of selecting a certain number of test wheels from each date of casting is condemned by manufacturers as being a tax too severe on their resources, for it sometimes means several tests for different purchasers on the same lot of wheels, or else several tests for small orders.

In place of these prevailing methods for the selection of test wheels, it would seem fairer to grant the manufacturer's assertion of his ability to produce wheels from day to day of uniform quality, and to provide for the testing of the various shrink-sizes represented in the total output. Then the effort from day to day must be carefully regulated and the effect of temporary mismanagement of the cupola or iron, and, in fact, the irregularities of the human equation, are more likely to be detected in the results of the tests on the several sizes.

By the proposed specification, if a failure occurs in any of the tests the opportunity is offered to test the wheels of the same size as the failed wheel from each date represented; and thus the possible rejection is limited to the particular wheels cast on the date of the failed wheel. This eliminates the necessity of condemning a quantity of wheels, about some of which nothing as to their quality is at all known.

The proper limit by which to define the depth of chill is disputed, and much variation in this measurement exists between individuals. To regulate this the specification introduces a clause defining the chill as that depth of clear white iron in which there are no spots or grain of the gray iron apparent. To prevent the mottling effect, sometimes seen in the blending of the white and gray iron, extending too far back into the rim of the wheel, a limit has been placed on the allowable distance from the tread that this effect can take place.

Under the present terms of the specification relating to the making of the thermal tests, there is generally a tendency to lessen its severity rather than to carry out the purchaser's intent. It is quite impossible to examine the ring formed to determine its freedom from layers or wrinkles, even though they indicate an undesirable temperature of the molten iron, and when the hot iron is poured slowly the test loses in force. Unquestionably the imposition of such practice as the use of cold iron and slow pouring should be within the inspector's prescribed authority, and it would therefore seem desirable to govern these features by as definite clauses as possible, and to limit the time of actual pouring to a period within the reasonable reach of the best practice.

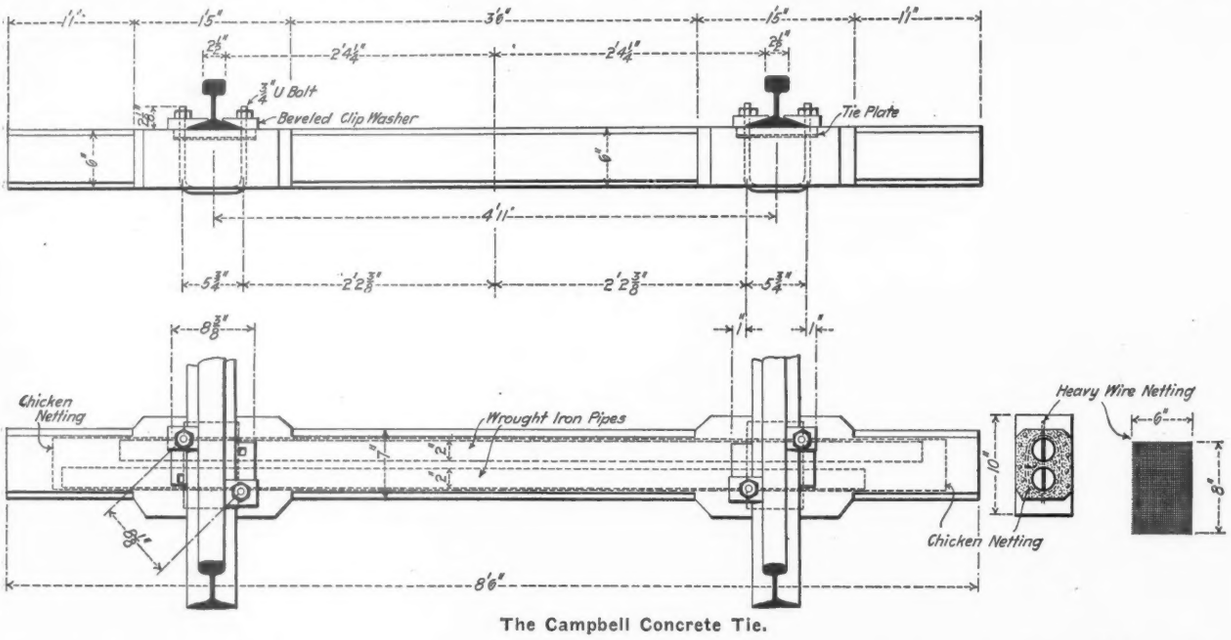
In other respects the proposed specification is simply a modification of the recommended form, only such alterations having been made as are warranted by the demand for standard wheels of a uniform quality.

The Campbell Concrete Tie.

The reinforced concrete tie shown in the accompanying drawings was designed by Mr. R. B. Campbell, General Manager of the Elgin, Joliet & Eastern Ry. It is 8 ft. 6 in. long and 6 in. x 7 in. in section with beveled edges, except under the rails where it widens to 10 in. for a distance of 8½ in. either side of the center of the rail. The corners of this widened portion are also beveled off to meet the body of the tie. Reinforcement is furnished by 2-in. wrought iron pipe, scrap boiler tubes being utilized for the purpose. There are two 7-ft. lengths of these, placed side by side. These tubes are surrounded, sides and ends, by a single thickness of common chicken wire fencing. On the center line of the tie, below each rail and parallel thereto, is a 6-in. x 8-in. plate of heavy wire netting inserted through specially punched openings in the pipes. The rail is held by beveled clip washers and a single U bolt placed obliquely to the longitudinal center line, as shown. A metal plate is imbedded in the tie under the rail.

A series of tests on a Riehle testing machine was made on a lot of 16 of these ties varying in construction, weight, proportions of mixture and age. The annexed table gives the properties of these ties, all being 7 in. x 7 in. and 8 ft. 6 in. long. All but Nos. 5, 7, 8 and 13 were tested by inverting the tie, supporting it at the rail points and applying the load at the center. Loading was begun at 1,000 lbs., and increased at the rate of 1,000 lbs. up to 4,000, after which the increments were reduced to 200 lbs. and continued to the breaking point. No. 15 gave the best results, breaking at 9,800 lbs., with an observed deflection at 9,600 lbs. of .415 in. No. 10 was the lowest, the break occurring at 4,000 lbs. Those between showed up, from highest to lowest, in the following order: 11, 9, 3, 4, 1, 2, 6, 16, 12, 14. Nos. 3 and 4 broke at equal loads, as did 2, 6 and 16, and 12 and 14.

Nos. 7, 8 and 13 had the pressure applied 9 in. from each end of the inverted tie supported at the rail points. The results show No. 8 to have broken at 14,200 lbs. with a deflection of .572 in.; No. 13 at 13,000 lbs., deflection .104 in.; No. 7 at 11,400 lbs., deflection .465 in. No. 5 was subjected to a crushing test at the rail point, the pressure being applied to a plate 10½ in. x 11½ in. on top



The Campbell Concrete Tie.

of the inverted tie, which had a plate 4½ in. x 12½ in. beneath it, next to the tie plate. At 80,000 lbs. a crack appeared on one side running vertically through the tie. Crushing came at 100,000 lbs.

Mr. Campbell says a number of these ties are in their main track where traffic is very heavy, and thus far have given entire satisfaction. They have given no indication of being affected by the weather, afford a uniform surface for the rail base and the ballast, and the rails under which they are laid keep in excellent surface. The cost of the tie will, of course, depend on the materials used, but he thinks they can be made and sold to the railroads at about $1.50, including tie plates, bolts, clips, etc. He says:

PROPERTIES OF CAMPBELL CONCRETE TEST TIES.

No.	No. of tubes.	Outside diameter of tubes.	Reinforced with woven chicken wire.	Kind of cement.	Weight of tie.	Proportions. Cement.	Sand.	Washed lake gravel.	Washed bank gravel.	Bank gravel.	Slag.	Crushed stone.	Limestone screenings.	Age of tie in days.
1.	2	2¼-in.	Yes.	Universal.	293 lb.	1	2	..	..	3	..	..	..	152
2.	2	2¼-in.	"	"	.....	1	2	..	3	..	..	..	..	116
3.	2	2¼-in.	"	"	401 lb.	1	..	..	..	..	..	3	..	116
4.	2	2¼-in.	"	Alpha....	.....	1	2	..	..	3	..	..	..	116
5.	2	2¼-in.	"	Universal.	.....	1	..	..	..	..	..	..	4	116
6.	2	2¼-in.	"	"	385 lb.	1	..	..	..	..	..	..	3	120
7.	2	2¼-in.	"	"	355 "	1	..	..	..	..	..	7	..	200
8.	2	2¼-in.	"	"	383 "	1	..	..	..	..	..	..	7	126
9.	2	2¼-in.	"	"	364 "	1	2	..	..	..	3	..	..	147
10.	1	3-in.	"	"	.....	1	2	..	..	3	..	..	..	119
11.	1	3-in.	"	"	.....	1	..	..	..	..	..	3	2	94
12.	2	2¼-in.	"	"	.....	1	..	..	..	..	..	..	4	117
13.	2	2¼-in.	No.	"	.....	1	2	3	..	..	..	..	..	196
14.	1	3-in.	Yes.	"	.....	1	2	..	3	..	..	..	..	196
15.	1	3-in.	"	"	311 lb.	1	2	3	..	..	..	..	..	195
16.	1	3-in.	No.	"	.....	1	2	..	3	..	..	..	..	195

"The life of such a tie should be at least 50 years. Estimating on this basis, which is equivalent to the life of six oak ties, costing in the track with tie plates and spikes, from 90 cents to $1, the railroads could pay $3 a tie, and still at the end of 50 years have saved 100 per cent. in maintenance."

Claims and Claim Agents.

This is the title of a paper read before the St. Louis Railway Club December 9 by S. D. Webster, a veteran claim agent. Mr. Webster has spoken on this subject before, but appears to have only partly satisfied the appetites of his hearers for entertainment in his line. He said that claims limited to one road could be easily settled; it is in dealing with other roads by correspondence that delays and wrangling stir up anger and hatred, and malice and all uncharitableness. Continuing, Mr. Webster said, in part: Ordinarily the handling of a claim should be simple. The claimant should show what goods were short or damaged. Confirmation should be attached by the delivering station agent. If receipted for at point of origin in good order and in full, the adjustment would be limited to ascertaining and agreeing to the amount to be paid. Still, it is to be said that this looks simpler than it is. So many deliveries are made where the damage is not detected, so many dishonest claims are presented, so many are ready to take advantage of a slight real to exploit an entirely fraudulent claim, that care has to be exercised as to all claims. And of late years there has come such an increase of both loss and damage claims that the normal number of persons educated in the handling of claim matters has not begun to keep pace with the abnormal increase of the claims.

The courts and lawyers have a body of rules and precedents known as common law. A similar condition of things exists in the freight claim agents' fraternity, and as these rules, like those of the lawyers, are based on sound reasoning, common sense and the principles of justice, they are deserving of the same recognition in their field. But business has increased so much faster than the forces in the claim offices have been enlarged that much of the work is largely done by inefficient men. Much of the correspondence coming into a claim agent's office appears to have been managed by persons from 7 to 14 years of age.

Others just look at the last paper or two and make a check mark on a ready-made hand-me-down-correspondence-sheet and fire it at some other fellow. Of this sort there is no end. Jim Dick had not so long ago a set of papers where all that was needed in the first place to set things right, was a letter from one agent direct to another. Instead, 35 papers had grown into the bundle and it was just where it was in the first place. It had to go to that agent at last. Hundreds after hundreds of these are going the rounds. They involve great labor and waste time.

What is the remedy? One hardly knows. Ignorance may be overcome by education. Experience helps because with it the clerk may (he does not always) avoid like previous errors. A systematic effort toward securing for those employed a means to this education and proper information should be adopted and its supplement of experience would show better results than if it is all left to chance, as at present. The pernicious classes should be reduced by an elevation of the moral tone. It should be made clear that the management wants the facts; that if the company is properly chargeable it wishes to know it and to pay what is right and proper under the circumstances.

The classification by "moves" should have a marked revision. How to secure efficiency is a considerable problem. Increase of pay may not obtain it; but it might assist in retaining the better men. Increase of force may not obtain it; but it might help, because the same number of claims would not average so many "movements" per man. But General Managers look with disfavor on any increase of the number of names or of the amounts shown on the monthly pay-roll. They have learned that about four men can be induced, because of their knowledge of the short-handedness of the office force, to do about five men's work. It is not fair to the men, of course, nor strictly honest on the part of the management, but that may be the way in which a manager made his reputation.

Mr. Webster closed with a detailed statement of the 23 different transmissions necessary in settling a claim of any amount (say one dollar) where the burden is to be borne by two different roads; each transmission involving from one to nine handlings.

In the discussion of the paper Mr. George F. Brigham, Jr., of the Chicago & North-Western, gave it as his experience that four-fifths of all claims are legitimate; but these are treated with the same suspicion as the other fifth, and thus good customers are offended. He mentioned a case where he was losing three hundred dollars' worth of business a week because of delay in paying a claim of less than $200.

Electric Railway Securities as Investments.*

Where a (street railway) company is earning no more than its fixed charges, including interest, taxes and guaranteed rentals, its bonds would not be considered investment securities. Where the net earnings exceed the fixed charges by 50 per cent., and the prospects of the company are good, the bond may be considered reasonably safe. Where net earnings exceed fixed charges by 100 per cent. the bond may be, generally speaking, considered entirely secure. These general rules are, however, subject to exceptions. Although there may be a large surplus over fixed charges, if the proper amount has not been spent for maintenance of the property, the "net earnings" are fictitious, and the bondholder is in no better position than although the company had laid aside a proper amount for depreciation and had no excess of earnings. On the other hand, where there is but a small excess of earnings, the securities of the company may be very attractive, as where a recently organized concern is under able management, with good prospects for increasing business.

The income of street and electric railways in the United States in 1902 amounted to $247,553,999. Of this income, the receipts from passengers amounted to 94.5 per cent.; from chartered cars, one-tenth of 1 per cent.; from freight, four-tenths of 1 per cent.; from mail, two-tenths of 1 per cent.; from express, two-tenths of 1 per cent.; from sale of electric current, 3.1 per cent., and from miscellaneous sources, 1.5 per cent. The percentage of operating expenses to gross earnings was 64.4 per cent. in 1890 and 57.7 per cent. in 1902. Of these operating expenses, maintenance of ways and structures cost 8.5 per cent. of the total, maintenance of equipment 11.7 per cent., operation of power plant 16.2 per cent., operation of cars 43.9 per cent., general expenses (including salaries, etc.) 19.7 per cent. These figures are of interest in their application to any special property as showing whether or not its operation is above or below such average. During 1902 there was an average rate of 5.1 per cent. paid on the stock of all companies which paid dividends, but on about one-half of the stock issued there were no dividends paid. Of taxes and fixed charges the interest on funded debt amounted to 45.4 per cent., and the rental of leased lines 32.9 per cent. The figures which are here given regarding electric railways have been compiled from the census reports, and the different items constituting operating expenses have been given in the percentage which they bear to the total expenses.

In comparing the operation of city lines with interurban lines, it will be found that the principal differences in cost occur in operation of power and operation of cars. Cost of power is proportionately less in city systems, owing to the greater economy in furnishing it from one central plant. On the other hand, cost of operating cars will be found less on the interurban line in proportion to gross receipts, owing to the fact that cars are generally larger, carry more passengers and operate at higher speed, with consequent larger receipts earned in any

*From a paper entitled "Securities of Public Service Corporations as Investments," by Albert L. Kramer, printed in the January number of *The Annals of the American Academy of Political and Social Science.*

given time, since the platform expenses—motormen's and conductors' wages—are practically the same per hour as on the city system. The total operating expenses of interurban lines in proportion to gross receipts average somewhat less than the operating expenses of city systems, showing the smaller operation of car cost to be a greater factor than the savings of the city lines from economical operation of power.

In a country with a growing population there is reason to believe that the earnings of street railway, gas and electric lighting properties will increase from year to year. The population of the United States, if the ratio of increase is maintained, will double within the next 50 years, and will even then show a density of from but one-fifth to one-seventh of that of European countries. The gross earnings of 445 electric railways for periods ending different months in the year 1903, show an increase of 10.45 per cent. over corresponding periods of the previous year, and the net earnings show an increase of 7.77 per cent.

It is possible to estimate with accuracy, from population and general conditions, what the earnings of a prospective railway, gas or electric plant will be during the first year of operation, and how those earnings will increase from year to year. The United Gas Improvement Company, of Philadelphia, for example, upon obtaining control of a property, generally reduces the price of gas, and from its long and thorough experience in the management of gas properties can estimate the extent to which this reduction will increase the output, taking into consideration the population of the territory and its ratio of increase. Good management can always swell the earnings of a property which has been before improperly managed, and many economies can be effected and policies adopted which will increase the earnings of the concern even though prices be reduced. The same considerations are applicable to street railway properties. The running of interurban cars on a half-hour schedule may or may not be a proper method of operation in a certain locality. It is frequently found that where cars have been so operated the changing of a schedule to a 15-minute one has resulted in considerable increase of earnings, since it is a fundamental principle of transportation that facility will create travel, and while the operating expenses are only slightly increased by the addition of a few cars, the added revenue from those cars may be almost entirely net profit. Furthermore, under a consolidation of properties such as has taken place in New Jersey under the management of the Public Service Corporation, a reduction in general expenses and in cost of operation, results in an increase of earnings which enables dividends to be paid on stocks on which there would otherwise be no return for years.

In the operation of interurban lines, the average fare throughout the United States is 1.3 cents per mile, although many lines operate profitably at 1 cent per mile. Below this rate, the operating expenses are apt to be too large in proportion to gross receipts to make profitable returns, while above 1.5 cents per mile the rate approximates steam railroad conditions too closely to develop the heavy travel which justifies frequent electric railway service. The concentration of generating power at some one point operating a number of motor units over an extended system is the attractive feature of an electric railway as compared with the steam railroad, but unless there is sufficient population to justify frequent service a given territory can scarcely be said to afford an electric railway enterprise.

The tendency with interurban lines recently constructed has been to build them on private right of way when possible. Although the original cost is greater, there are a considerable number of reasons for so building them. The greater speed saves the passengers' time and is an inducement to travel which is specially noteworthy where the private right of way runs through city limits. The slow trailing behind the city trolley cars and wagons is avoided, and the company is not subject to municipal speed restrictions. The private right of way is also important from the operating standpoint. The expenses of handling given traffic will be less, since there is no paving to maintain and the expenditure on maintenance of track, bridges and tie renewal is less because of the lack of wear and tear of extraneous traffic. The greater speed on a private right of way will not only make the service more reliable, but also decreases the accident and legal expenses, and has many other advantages. It will be thus seen that a road operating over its own right of way will have a lower operating ratio, and will in consequence have a larger surplus over fixed charges, provided that the securing of the right of way has not been so expensive as to make the amount of the bonded indebtedness too large. It is a problem with every prospective street railway, gas and electric light company as to how much can be safely spent for buildings, plant, trackage, wiring, etc., as it is, of course, possible to make these so expensive that the company will be unable to earn anything in excess of the interest on the money so spent. On the other hand, there are many improvements every year which are not only desirable from the standpoint of creating traffic, but also in order to enable the company to operate at a lower ratio. This is forcibly shown in the decrease of the operating expenses in street railway properties from 64.4 per cent. in 1890 to 57.5 per cent. in 1902.

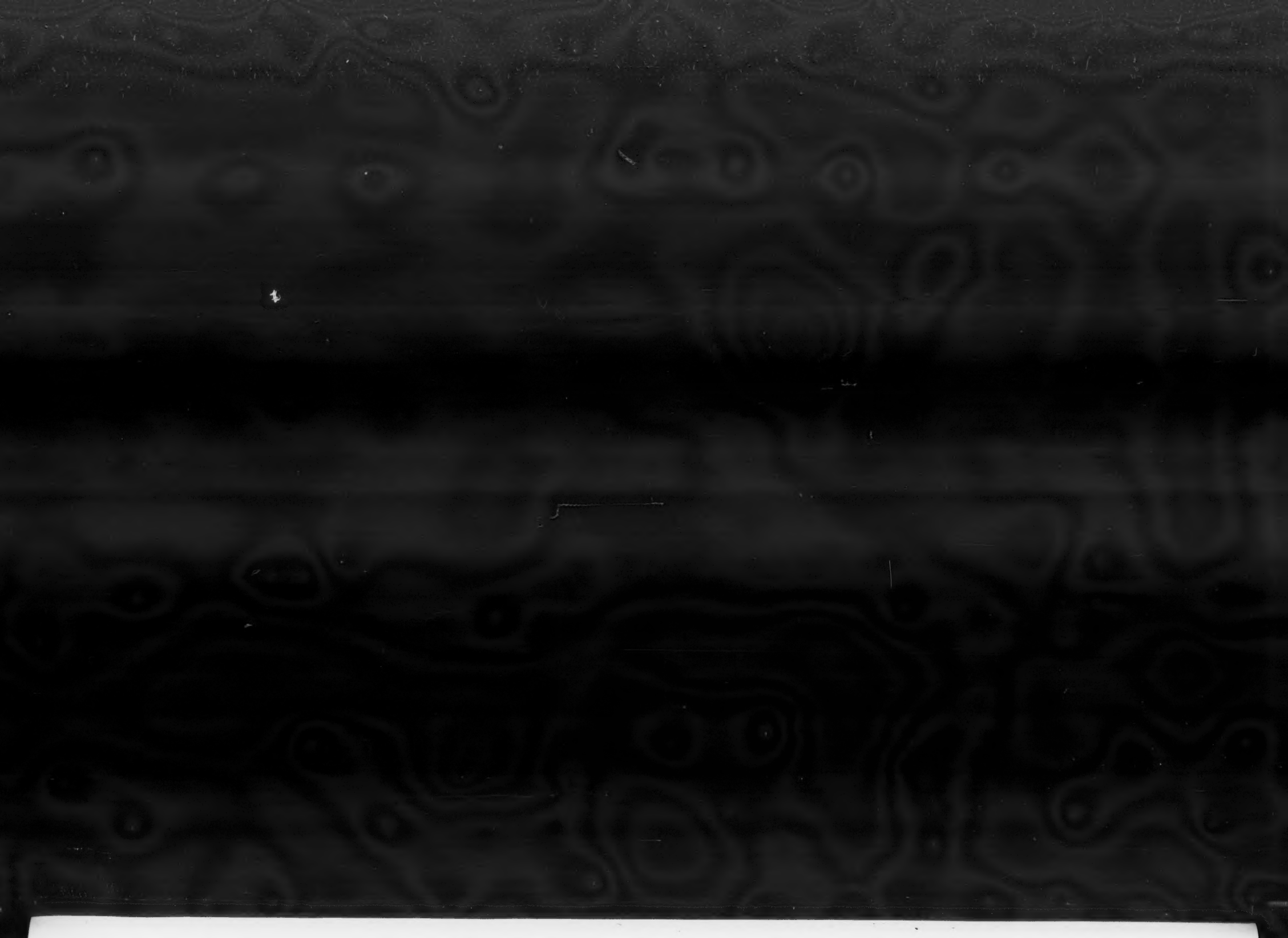
We have so far dealt mainly with those companies which are in operation. In many instances investors are asked to purchase bonds in companies not in operation, where earnings are apparently problematical. The science of street railway, gas and electric lighting properties is, however, so complete and exact that it is usually possible to estimate what the earnings of such companies will be. There are very few cases where lines intelligently established have been unsuccessful. Many considerations must be taken into account, but where the knowledge of the business is supplemented by common sense, such investments are usually secure. Just as the life insurance company calculates its financial returns with the utmost confidence from the average life of humanity, so each inhabitant of any given community has been found to reward with a certain number of dollars per annum the electric company serving him. Electric railway territory must be divided into the local system in the town of 10,000 population and the city of 100,000 to 1,000,000 population, and the average earnings per capita determined in each. Factors of calculation must be used intelligently in each case. The shape of the city, whether elongated, circular or compact, must be considered, as must also the character of its population, their residence location with reference to places of employment, and the relative prosperity. Calculations of suburban and interurban earnings are more complex, being dependent in addition to the above conditions on the number of the local populations along the line and the distance from the terminal cities to where they are tributary, rather than upon the exact size of the terminal cities. To develop a maximum of earnings per capita from the local population along the line, the terminal city should be several times larger than the local towns and villages, so that the latter are in the fullest sense commercially tributary. The question of franchises, equity in the property and rights of way must also be considered by the prospective buyer of a bond of a company not in operation.

The problem of the organizers of such a company is the same as that of the investors if they are going to stand by the property, but sometimes concerns are organized during speculative booms merely for stock jobbing purposes, and where suspicion of good faith exists the closest scrutiny is necessary. A road may be so cheaply built that in the course of a few years the power plant and equipment will be worn out, and the bondholders will find their property in the hands of a receiver. If proper attention has been given to these matters, the main things to be considered are the population of the territory and the activity of that population. If the line is to be built through a country where there is but little industrial or farming population which travels, the earnings, of course, will not be so great as in the case where the line is to be constructed through a territory having a similar population which is continually traveling between the different points. Investors are frequently found who will not put their money in the bonds of a company which operates in a community depending upon any one industry, as in the coal regions in Pennsylvania, where in the event of a strike the earnings must necessarily fall off considerably. Where the road is built along the bank of a river it can in some instances only draw from the population on that side, and unless that population is double per mile of road than ordinarily required the line can hardly be a success.

Another class of electric railway companies which have frequently been found unprofitable are those operating during a portion of the year only, although there are, of course, a large number of lines which are paying satisfactory returns to the stockholders which are dependent for their earnings entirely upon the summer season, such as those running to parks and summer resorts having a large patronage. Unless the traffic is unusually heavy during the summer these roads will naturally not pay, as if they operate for only six months in the year, they must do twice the business which would ordinarily have to be done in a year in order to meet the charges on the capital invested. A number of such companies operating their cars during the entire year, operate at a loss during the winter months, so that during the summer season not only do they have to do a double business, but have also to make up a deficit.

The future of electric railway, gas and electric lighting companies is promising. These industries have not only tributary to their lines or plants an increasing population, but a population which makes increasing demands upon their facilities. The time is not far distant when the bonds of many public service corporations now selling on a 5 per cent. basis will be regarded as "gilt-edged," and it is doubtless true that some of the great fortunes of the future will be made by purchases of the stocks of interurban lines just as they were made by investment in railroad stocks years ago, and more recently in the stocks of city electric railway companies.

The Austrian court of last resort has decided that the sale of a through ticket, entitling the holder to break his journey once and marked "not transferable," by a passenger who has used his "stop-over" privilege, is a criminal offence. The railroad is entitled to recover full fare for the distance traveled.



GENERAL NEWS SECTION

NOTES.

The Pension department of the Vandalia Railroad is now in operation, and, according to press despatches, every employee of 70 years old, or older, was retired on the first of this month.

Congress has passed the bill, which has been before it for several weeks, authorizing the construction of railroads in the Philippine Islands, and the President has signed it. Under this bill the Government of the islands is authorized to guarantee 4 per cent. interest on 30 millions of dollars' worth of bonds for railroad construction in the islands.

President F. D. Underwood, of the Erie, has sent to the stock and bond holders of that company a circular calling their attention to the bills now pending in Congress relating to governmental regulation of freight rates, and suggesting to the investors that if they wish to use their influence to aid in preventing the serious mistake of empowering the Interstate Commerce Commission to fix rates, they should express their views to the committees in charge of the bills.

The last fortnight has been marked by very low rates on export grain from Missouri River points both to the Atlantic Seaboard and to the Gulf of Mexico. As very little grain is now moving, the apparently frantic movements of the rate reducers are of little real importance, outside of traffic offices; but the following despatch of February 4 may be of passing interest: "The lowest published rate from Omaha to the Gulf to-day, on corn for export, is 11 cents per 100 lbs., by the Missouri Pacific. The Burlington has made a through rate of 13 cents from Omaha to Baltimore. It claims that the Missouri Pacific is paying 2 cents per 100 lbs. for terminal charges at New Orleans, making a net rate of 9 cents from Omaha to New Orleans. The Gulf roads contend that the Burlington and its Eastern connections have reduced the differential in favor of the Gulf ports to 2 cents on shipments via Baltimore, and to only ½ cent on shipments via New York, as at that port a deduction of 3 cents is made from the rate to cover lighterage expenses."

Railroad Co-operation Needed.

It cannot be too strongly urged upon railroad managers that the situation with respect to railroad legislation is one calling for their earnest co-operation with the administration looking toward the passage at this session of Congress of some legislation dealing with the subject. The first, and as we have already pointed out, the central fact is that something must be done. The thing that should be done is to remove the railroads from the scope of the Sherman anti-trust law, which is a law in no sense of the word devised to deal with natural monopolies, and to bring the railroads under sufficient public control in another way.

Railroads are natural monopolies and cannot be anything else. The Sherman anti-trust law was designed to deal with entities which are not naturally monopolistic in character. The Sherman law, however, is on the statute book, and it has been held by the Supreme Court to apply to railroads. This is the condition that has to be faced. As monopoly corporations, the railroads, must be subject to some kind of control at the hands of the government. The principle is almost self-evident. The thing to be done is, therefore, to provide for this control and do it in a manner which shall be wise and permanently effective.

The time has gone by for futile argument, proving or attempting to prove that nothing can be done. The present condition of the statute book is not suited to deal with the present condition of facts. It is ridiculous to suppose a condition of facts that cannot be provided for on the statute book. We suggest that railroad managers should devote all the energies that they have available for this subject to assist the administration to bring order out of the present chaos. They can do this, if they will in good faith, make an honest attempt. Happily some of the most influential among them, seeing the necessity are trying to meet it. Some influential railroad men are still blind to the necessity and are fighting tooth and nail against the inevitable. The objection to this course is first that it is doomed to failure, and second that it will make the ultimate solution imperfect in that it may prevent full justice being done to the railroads.

The problem is difficult. No more difficult problem so far as detail is concerned, has come before Congress since the Civil War. The principles, however, are clear, and the difficulties are of detail. It is most desirable that legislation should be had at this session, providing that it can be had on proper lines. To throw the matter over to an extra session will simply mean the raising of prejudices of both sides to a fearful heat, which will be an almost an insurmountable barrier to fair dealing. Railroad managers should give up what is a hopeless fight against a principle that is bound to win, and should work to see that the principle is properly applied. Why cannot a committee of railroad men be gotten together to help the administration in this matter?—*Wall Street Journal.*

The Safety Nut Lock.

A cheap and simple form of nut lock is shown in the accompanying illustrations. It can be applied to any style or quality of nut without difficulty. A slot proportionate in

The Safety Nut Lock.

size and depth to the size of bolt and nut is milled into one face of the latter, near a corner in order not to weaken the nut. In this slot a wire is swaged cold and then cut off to a length suitable to lock the nut in any position on the bolt. For a ½-in. bolt No. 12 wire is used, the material being of best quality to withstand frequent bending and still last the lifetime of the bolt. Two slots, at right angles, are milled in the end of the bolt so that the nut can be locked at every quarter turn. For shipping, the nut is placed upside down on the bolt. For automobiles and fine machine work a lock exactly flush with the top of the bolt is made, with three slots in the end of the latter to permit locking at every one-sixth of a turn.

The addition of this lock increases the cost about 20 per cent. With the use of improved machinery, now being built, it is expected to reduce this figure materially. The Safety Nut Lock Co., Minneapolis, Minn., is the maker.

Grade Crossing Disaster at Arkport, N. Y.

On the evening of February 1 a sleigh occupied by 13 women and a driver was struck by a train of the Pittsburg, Shawmut & Northern at Stephens' Crossing, near Arkport, N. Y., five miles from Hornellsville, and 10 of the women were killed, or badly injured; seven were killed instantly, three died soon after, and the other three were seriously injured. People in another sleigh ahead, both loads being members of a church party, crossed the railroad in safety, and tried to warn the driver in the second sleigh, but they failed. This driver, who was injured, said afterward that he was unable to control his horses.

Illustrious Examples.

President A. B. Stickney, of the Chicago Great Western, speaking before the Washington (D. C.) economic society February 3, on the evil of rate discrimination, referred to the fact that there are rate discriminations in passenger as well as freight traffic. He said: "The law which makes it a misdemeanor for any individual not an officer of a railroad company to use a pass was enacted by Congress and approved by the President 15 years ago, and as an individual rule of action it was ignored by the Congressmen who passed it and by the President who approved it; and subsequent Congressmen and Presidents, with rare exceptions, have ignored its provisions. The Governors of the states, many of the judges—in short, all officialdom from the highest to the lowest—the higher clergy, college professors, editors, merchants, bankers, lawyers, violate the law in the same manner.

The King of England, said Mr. Stickney, pays regular fare while traveling, and so do members of Parliament and minor public officials, and the result is that the law of England against railroad discriminations is effective. What the country needs to break the trance is an illustrious example, like the example of the King of England. There is one man, and but one man, whose example would be effective; and, unless the American people have misjudged his character, if he realized that he was transgressing the law in accepting the courtesy of free transportation, Theodore Roosevelt would have the virtue and the courage and the ability to set the example, which shall awaken officialdom and all good citizens to a sense of the individual duty to obey this law.

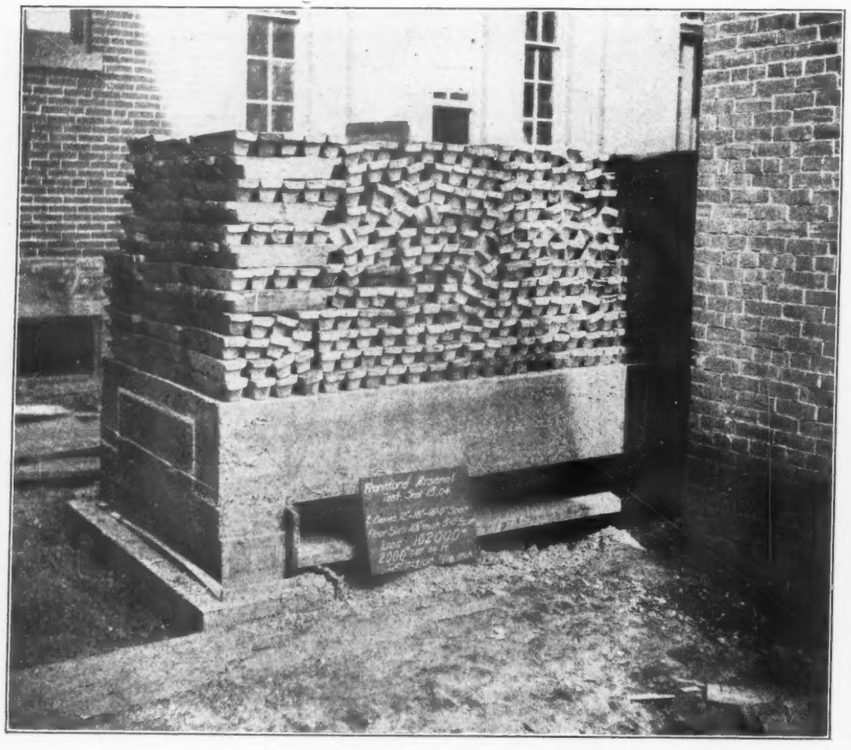
The *Springfield Republican* commenting on Mr. Stickney's address says: "A great example would prove equally effective in the case of freight discriminations, and the opportunity is now within reach of the government to provide such an example. The Santa Fe is charged by the Interstate Commerce Commission with continuous violation of the anti-rebate laws for several years back, and its case has been turned over to the United States department of justice. The responsible railroad officials, if convicted,

cannot now be imprisoned, and if their testimony is needed to prove the company's guilt they may not be fined. But the company itself can be fined for each separate offense, and the favored shipper—in this case, the Colorado Fuel & Iron Co.—can be fined.

"It ought to be possible, therefore, to prove enough distinct offenses to make these companies suffer to an extent which will force the resignation of their high officials, and make an example which will spread fear and trembling among the managements of railroads and large industrial corporations throughout the country. Railroad managers say that they would have these laws made effective. Do they desire that to the extent of throwing their great influence upon the side of the attorney-general in the effort to make of this particular case of law-breaking a shining and terrible example in the transportation industry?"

Test of a Reinforced Concrete Floor.

This test was conducted at the Frankford Arsenal, Frankford, Pa., last fall by James A. Brown, C. E., Engineer of the arsenal. The object was to determine the efficiency of a concrete floor designed in accordance with the Kahn system of reinforced concrete before incorporating it in the small arms ammunition storehouse, now being built at the arsenal. Cartridges and other ammunition are to be stored in the building, and the floor will have to carry a live load of 425 lbs. per sq. ft. The girders are designed to support 72,800 lbs. on 19 ft. 3 in. spans. The floor slab is 4½ in. thick, and it is carried by 12 in. x 16 in. beams spaced 5 ft. on centers, 16 ft. 6 in. span. These beams



Test of a Reinforced Concrete Floor.

in turn are supported by 18 in. x 30 in. girders, 19 ft. 3 in. span. The reinforcement was with Kahn trussed bars. In the bottom of the girders there were 1¼ in. bars which ran full length. There were also two 1¼ in. bars bent up at the one-third points, and one 1 in. bar at the center. A 1¼ in. compression bar was placed at the top of the girder at the center. The beams were reinforced with two 1¼ in. bars running full length, and one ¾ in. bar running half the length of the span. The slab contained ½ in. round rods placed 6 in. on centers.

Pig lead, weighing 100 lbs. each, was used for loading. This was piled up in rows to prevent any arch action occurring. The floor slab and beams were tested first, a full safe load of 425 lbs. per sq. ft. over the entire area causing no perceptible deflection. Loading was continued until the slab carried 162,000 lbs., or 2,000 lbs. per sq. ft. Carrying this loading the beams deflected $^{11}/_{16}$ in. The elastic limit of the steel not having yet been developed, it was assumed that the ultimate strength of the slab was double the load now placed upon it. The slab being isolated, no provision could be made for a continuous action, such as is obtained by reversing the reinforcing bars in beams over the points of support. This reversing of the bar, it is said, gives an additional strength of one-quarter the carrying capacity of a simple beam. Loading was discontinued at 162,000 lbs. as the action of the floor under this load was regarded as proving that in actual construction the floor slab would easily have a safety factor of 4.

The girders were also loaded with 100-lb. lead pigs. With a load of 72,800 lbs. on the platform of the girder the deflection was about $^{2}/_{32}$ in. A load of 216,000 lbs., nearly three times the safe live load, merely developed the elastic limit of the steel. As was determined by the development of hair cracks, the deflection at this point was about $^{7}/_{16}$ in. In all previous tests made on beams reinforced with Kahn trussed bars these hair cracks have occurred at a load equal to half that which caused ultimate failure. It was therefore considered that these girders would have carried 400,000 lbs. before absolute failure.

At the suggestion of Lieut. Col. Heath, Commanding Officer of the Arsenal, the load was left on the girder to see whether any further deflection would result therefrom. No further deflection was noticed after 20 days. The concrete was 28 days old when the tests were made.

Major W. F. Goodspeed.

Major Wilbur F. Goodspeed, President and Treasurer of the Buckeye Steel Casting Company, died suddenly at his home in Columbus, Ohio, on February 4, at the age of 68. Major Goodspeed had been in apparently good health up to the night before he

Major W. F. Goodspeed.

died, the cause of death being heart failure. Major Goodspeed was born in Massillon, Ohio, and until the war broke out was connected with a relative in the wholesale shoe business. In 1861 he entered the First Ohio Light Artillery, being elected First Lieutenant. He was rapidly promoted, having been repeatedly commended for brilliant service. At Chickamauga and again in the Atlanta campaign he averted serious disaster to the Army of the Cumberland. At the close of the war Major Goodspeed returned to Cleveland, and was United States marshal for about 10 years. He went to Columbus in 1886, and had been connected with the Buckeye Company and its predecessor since that time. He was also a Director in the Hocking Valley Railway, the Central Ohio and other roads, and President of the Commercial National Bank. He is survived by a widow and one son. Major Goodspeed was as popular socially and in military circles as he was in the business world, and was noted for his public spirit and warm interest in many religious and charitable institutions.

Lundell Universal Motors.

Last fall the National Electric Company, Milwaukee, Wis., entered into an arrangement with Mr. Robert Lundell to make and market the new motors and generators and systems of operation and control covered by the latter's latest inventions. A bulletin on Lundell universal motors has just been issued from which the following description is taken.

The yoke is laminated mild steel to insure uniformity of magnetic circuits, greater flexibility of speed control, quick field regulation, and a more compact structure. The frame containing the laminated yoke rings and supporting the bearing brackets is a rigid open casing of cast iron, made in two parts. The rear of these two parts may be seen in the accompanying view of the laminated yoke, supporting the latter. It has four hollow extension arms of strong cross-section, accurately bored to fit the yoke rings. The frame parts are bolted together, forming a stiff structure, independent of the yoke for stability and alinement. The pole pieces also are laminated, and are punched from material similar to the yoke rings. They have end plates with ventilating ducts to carry off the heat of the field coils. The pole pieces are secured to the yoke by

means of two bolts each, which pass through the latter and are tapped into the end plates.

As a result of the low losses in this design, armatures in machines up to 60 h.p. are not ventilated through the center. For this same reason they may be enclosed without serious rises in temperature resulting. The armature coils are all form wound and are separately insulated independently of the slot insulation. Supporting rings cast

Lundell Universal Motor.

in one piece with the core end-plates hold the armature coils securely in place. The commutators are built on the lines of standard street railway practice. The commutator shells are ventilated through their centers.

The brush device involves a new principle. Instead of having the brushes on a stud side by side, parallel to the commutator bars, they are placed tandem. With the old arrangement, any irregularity across the commutator surface parallel to the brushes causes both to jump at the same time, momentarily opening the circuit for that stud. With the tandem brushes, only one at a time is affected, thereby keeping the circuit closed for the stud. Experience shows that the temperature of the commutator remains lower on

Laminated Yoke.

this account, and its surface in much better condition. Where field control is used to obtain wide ranges of variation in speed, or where conditions of service require special commutating conditions, the brush at the leaving edge is made of high resistance carbon to take care of sparking conditions, and its mate of high conductivity to carry the current. This dual brush thereby performs two conditions of service ordinarily opposed to each other.

In performance, these motors show small temperature increases and are able to carry heavy overloads for considerable periods without injury. Full loads are carried continuously without sparking, and the brushes give the commutator surface a fine high polish, while themselves wearing down to a true bearing surface. The highest efficiencies are claimed for these motors.

American Shipyards in 1904.

The following table, from the *Glasgow Herald*, reviews the tonnage launched at American shipyards in 1904 and in 1903. It will be seen that the total for 1903—493,144 tons—is nearly 170,000 tons greater than the total for 1904.

Company.	Sailing Vess'ls.	Sailing Tons.	Steam Vessels.	Steam Tons.	Tons Total	Tons 1903.
The Newport News Co.	..	.....	10	43,000	43,000	27,360
Union Iron Works, San Francisco	..	.....	4	37,574	37,574	13,168
The Fore River Ship Building Co.	2	500	8	34,550	35,050	12,628
American Company (five yards)	1	800	8	33,175	33,975	166,288
Dockyard Warships	..	.....	2	17,800	17,800	.....
Wm. Cramp & Sons Co.	..	.....	5	17,559	17,559	39,846
The Bath Iron Works	..	.....	1	15,000	15,000	2,365
The Moran Bros. Co.	..	.....	1	15,000	15,000	.....
The Delaware River Co.	..	.....	2	10,933	10,933	14,780
The Maryland Steel Co.	..	.....	8	10,501	10,501	17,754
Kelly, Spear & Co.	10	8,068	..	.....	8,068	6,102
The New York Ship Building Co.	1	750	7	6,192	6,942	37,764
Percy & Small	2	6,229	..	.....	6,229	7,026
The Wm. R. Trigg Co.	..	.....	2	6,000	6,000	.....
The Great Lakes Works	..	.....	3	4,696	4,696	8,000
The New England Co.	4	4,255	..	.....	4,255	7,330
R. Palmer & Son	3	3,692	..	.....	3,692	.....
M. B. Macdonald	6	3,950	..	.....	3,950	.....
Washburn Bros.	3	3,347	..	.....	3,347	3,988
Cobb, Butler & Co.	2	2,790	..	.....	2,790	1,102
The Thames Shipyard	1	2,500	1	100	2,600	1,100
The Neafie & Levy Co.	..	.....	10	2,500	2,500	2,170
Gas Engine & Power Co.	..	.....	7	2,261	2,261	.....
Harlan & Hollingsworth	1	1,000	2	1,025	2,025	9,841
The Craig Co.	..	.....	2	1,730	1,730	11,564
E. & J. K. Stetson	1	1,589	..	.....	1,589	.....
J. H. Dialogue & Son	..	.....	4	1,177	1,177	5,436
Burlee Dry-Dock Co.	..	.....	5	1,175	1,175	6,516
F. S. Bowker & Son	2	1,045	..	.....	1,045	1,253
The Hall Bros. Co.	..	.....	1	1,008	1,008	1,260
The Globe Co.	1	845	..	.....	845	1,410
Union Engine Works	..	.....	2	825	825	1,155
The Baltimore Co.	..	.....	1	795	795	1,200
The Merrill-Stevens Co.	..	.....	2	516	516	1,250
The Risdon Iron Works	..	.....	1	365	365	200
W. A. Boole & Son	..	.....	1	175	175	1,267
The Fulton Works	..	.....	1	158	158	200
The Eastern Ship Building Co.	..	.....	..	.....	.....	44,000
Other firms	8	14,137	5	2,888	17,025	37,812
Total for 1904.	48	55,497	106	268,678	324,175	.....
Total for 1903	41	57,797	147	435,347	.....	493,144

Manufacturing and Business.

The Tatlow Turntable Attachment Co., Denver, Colo., has shipped one of its machines to the Southern Railway for use at East St. Louis, Ill.

Announcement is made by the Weber Railway Joint Mfg. Co. that Guy A. Hagar has been appointed sales agent at St. Louis, with office in the 'Frisco Building.

Bids are wanted by B. Leighton Beal, Secretary of the Boston Transit Commission, 15 Beacon street, Boston, Mass., February 14, for building section 4 of the Washington street tunnel from about 30 ft. north of Hayward place to about 15 ft. south of Franklin street.

Bids are wanted Mar. 7 by the Commissioner for Railways at Brisbane, Australia, for 2,000 tons of rails and 168 tons of fish plates. Specifications can be had from the Agent-General for Queensland, 1 Victoria street, London, England.

About 75 traveling salesmen of the electric railway and lighting department of the Westinghouse Electric & Manufacturing Company attended the annual gathering at Pittsburg during the week of Jan. 30-Feb. 4. Mr. C. S. Cook, manager of the department, presided at the various meetings.

Bids are wanted at the office of the Connecticut River Bridge & Highway District Commission, Hartford, Conn., February 27, for filling and grading various streets, railroad tracks and approaches, involving about 325,000 cu. yds. Morgan G. Bulkeley is President of the Board of Commissioners.

The board of officers appointed by the Secretary of the Navy to investigate the capacity of the shops of the bidders, has recommended that the Midvale Steel Company's bid for 8,000 tons of armor be rejected; and the contracts for armor for the battleship New Hampshire and the cruisers North Carolina and Montana have been let as follows: To the Bethlehem Steel Company, the armor for one battleship and one armored cruiser, 5,666 tons, and all bolts and nuts, 94 tons. To the Carnegie Steel Company, the armor for one armored cruiser, 2,162 tons. While the Midvale Steel Company has submitted trial plates that have successfully withstood the required ballastic test, it has not yet begun the regular production of armor in quantity.

An order has been given to John F. Allen, 372 Gerard Ave., New York City, maker of the Allen Portable Pneumatic Riveting Machines, for six Allen riveters to be sent to the Cia Consolidada de Construcciones Metalica, S. A., of Mexico City, Mexico. Mr. Allen has an agency in the city of Mexico (A. H. Le Hand & Co.).

The annual convention of officers and branch members of the Crocker-Wheeler Company was held at the works, Ampere, N. J., January 26-28. Managers and representatives were in attendance from all parts of the country. On the evening of the 27th a banquet was held at the Cafe Martin in New York, at which President Wheeler presided.

The A. S. Cameron Steam Pump Works, of New York, has sold three more of its horizontal pumps to the O'Rourke Construction & Engineering Co., New York. These pumps are to be used in connection with the improvements in the Pennsylvania Railroad tunnel. A number of these pumps are also being used along the line of the improvements in the New York Central terminal in New York City.

The formation of the Kilgore-Peteler Company, Minneapolis, Minn., was announced last week. The capital of the new concern is $200,000, and the officers and directors are: Chas. S. Hale, President; Geo. W. Bestor, Vice-President; Frank C. Bestor, Secretary and Treasurer; Philip Peteler, Superintendent. The plant of the company on 30th avenue southeast, formerly the Peteler works, will be enlarged to provide for the manufacture of the products of the combined companies.

Bids are wanted Feb. 28 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing machine tools, etc., at Portsmouth, Boston, New York,

Washington, Norfolk and Pensacola, as follows: Engine lathe, centrifugal pumping sets, radial drill, planer, band saw, knife grinder, deck winches, milling machine, gear-cutting machine, drilling machine, saw table, boring machine, scroll saw, band-saw filer, band-saw setter and retoother and shear. H. T. B. Harris, Paymaster-General, U. S. N.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

New York Railroad Club.

The next meeting of this club will be held at Carnegie Hall, February 17. Mr. Charles Streicher, of Butler, Pa., will present a paper on "Running Railroad Shops on the Monthly Appropriation Plan."

Franklin Institute.

At a meeting of the Electrical Section held February 9, the program included a paper on "The Inspection of Electric Conductors, with Special Reference to Fire Protection," by Washington Devereux, of Philadelphia.

Cleveland Railway Club.

A railroad club bearing this name was formed in Cleveland, Ohio, Thursday, Jan. 26th. The charter members are principally locomotive and car men, though representatives from all departments are eligible for membership and are desired. Meetings will be held once a month. The officers are: President, W. Cottrell, General Foreman Erie R. R.; Vice-President, G. M. Bunting, General Foreman C. & P. R. R.; Secretary-Treasurer, J. C. Dennerle, Clerk, L. S. & M. S. R. R.

PERSONAL.

—Mr. A. J. Hemphill, whose resignation from the Secretaryship of the Norfolk & Western was announced last week, is now a Vice-President of the Guaranty Trust Company of New York City.

—Mr. Cornelius Conway Felton Bent, who succeeds Mr. Fitzgerald as General Superintendent of the Baltimore & Ohio, is about 56 years old. He was born in Boston, Mass., and entered railroad service in 1867 as chainman of engineers' corps on the Lake Superior & Mississippi in Minnesota. From then until 1875 he was engaged in engineering work and then went to the Pennsylvania as Assistant Supervisor; and in 1879 he was made Assistant Engineer on the Pittsburg, Cincinnati & St. Louis, and in 1881 he was promoted to be Superintendent. In 1884 he went to the Louisville, New Albany & Chicago. Mr. Bent has been on lines which are now in the Baltimore & Ohio System about 19 years, having begun on the Ohio & Mississippi, now a part of the Baltimore & Ohio Southwestern, where he was for many years General Superintendent. In 1894, on the consolidation of the Baltimore & Ohio lines west of the Ohio River he was transferred to the eastern lines and appointed Superintendent of the Philadelphia Division, and he has held that position until now, being also General Agent of the company at Philadelphia.

—Mr. William B. Biddle, who from March 1 will be Third Vice-President of the Chicago, Rock Island & Pacific, has for the past 11 years been head of the traffic department of the Atchison, Topeka & Santa Fe. Mr. Biddle was born at Beloit, Wis., in 1856. He began his railroad career in 1878 as a freight brakeman on the "Atchison," and has been on that road or its controlled lines all his life. From the train service he was promoted to be station agent and then to a clerkship in the general office of the Atlantic & Pacific. In 1886 he was appointed Assistant General Freight Agent of that road, and then Division Freight and Passenger Agent. In 1888 he was made Assistant General

Freight Agent of the Atchison. This position he held for two years, when he was promoted to be Assistant Freight Traffic Manager; and he has been Freight Traffic Manager since 1894.

—Mr. George H. Crosby, whose promotion to be Freight Traffic Manager of the Chicago, Burlington & Quincy, is announced, has for the past three years been Assistant Freight Traffic Manager. Mr. Crosby has been in the service of roads in the Burlington System, with the exception of a few months, since 1872. He began on the Hannibal & St. Joseph and remained with that company for

four years. He was then claim clerk in the general freight office of the Chicago, Burlington & Quincy. For a short time in 1877 he was on the International & Great Northern, but returned to the Burlington, and was sent to Hannibal, Mo., as chief clerk in the general freight office there. In 1881 he was appointed General Freight Agent of the Kansas City, St. Joseph & Council Bluffs, and two years later was appointed Assistant General Freight Agent of the Burlington & Missouri River at Denver, where he remained until 1890, when he was promoted to be General Freight Agent at Omaha. Mr. Crosby was appointed to the position he now leaves in 1902.

ELECTIONS AND APPOINTMENTS.

Arkansas Southern.—S. E. Dillon having resigned, the position of Superintendent of Car Service has been abolished.

Atchison, Topeka & Santa Fe.—Alfred Lovell, hitherto Assistant Superintendent of Motive Power, has been appointed Superintendent of Motive Power.

E. D. Kenna, First Vice-President and General Solicitor, has resigned. He is succeeded as General Solicitor by G. Lathrop.

L. U. Morris, hitherto Trainmaster at Dodge City, Kan., has been appointed Superintendent at Wellington, Kan., succeeding T. J. Whisenand.

Atlantic Coast Line.—O. H. Page has been appointed Acting Superintendent of Transportation of the First Division, with office at Wilmington, N. C., succeeding W. J. Haylow.

Buffalo, Attica & Arcade.—The officers of this company are: President, F. H. Goodyear; Vice-President, C. W. Goodyear; Secretary and Treasurer, F. A. Lehr; General Freight and Passenger Agent, H. H. Gardiner, and Auditor, W. H. Baumes.

Chicago & Calumet River.—Clive Runnells has been appointed Traffic Manager, with headquarters at Chicago, Ill., succeeding C. W. Dysart.

Chicago & Eastern Illinois.—R. R. Hammond, Second Vice-President and General Manager, has resigned. W. J. Jackson, General Superintendent, will temporarily assume the duties of General Manager.

Chicago, Rock Island & Gulf.—A. B. Crowley has been appointed Superintendent of Telegraph.

Chicago, Burlington & Quincy.—George H. Crosby, hitherto Assistant Freight Traffic Manager, has been appointed Freight Traffic Manager, succeeding the late Thomas Miller.

Cincinnati, Hamilton & Dayton.—F. S. Rawlins has been appointed Superintendent of Car Service, with headquarters at Cincinnati, Ohio, succeeding G. H. Waldo, resigned.

Cleveland, Cincinnati, Chicago & St. Louis.—C. L. Hilleary, Assistant General Passenger Agent, has resigned. It is understood that Mr. Hilleary is to become Chairman of the Business Men's League of St. Louis.

Cornwall.—E. A. S. Clarke has been elected Vice-President, with office at New York, N. Y.

Denver & Rio Grande.—W. Miller has been appointed Master Mechanic, with headquarters at Burnham, Denver, Colo., succeeding W. L. Calvert, resigned.

Fort Worth & Rio Grande.—C. E. Boss has been appointed Master Mechanic, with headquarters at Sherman, Texas.

Great Northern.—R. E. Taft has been appointed Resident Engineer at West Superior, Wis., and H. F. Hamilton, Resident Engineer at Havre, Mont.

Great Western (Colorado).—E. R. Griffin has been appointed General Manager, with headquarters at Denver, succeeding A. V. Officer.

Gulf & Interstate.—L. L. Featherstone, hitherto Secretary and Superintendent, has been appointed Acting Traffic Manager, with headquarters at Beaumont, Texas.

Indiana, Illinois & Iowa.—See Lake Shore & Michigan Southern.

Lake Shore & Michigan Southern.—G. J. Grammer, hitherto General Traffic Manager at Cleveland, has been elected Vice-President. George Wagstaff, having been promoted, the position of Assistant Master Mechanic has been abolished. M. D. Franey has been appointed Superintendent of Shops, with headquarters at Collinwood. P. L. Fisher has been appointed Auditor of Disbursements at Cleveland. H. A. Worcester, hitherto Superintendent of the Eastern Division, has been appointed Superintendent of the Western Division, with headquarters at Chicago, succeeding H. A. Ziesel, who is Superintendent of the Indiana, Illinois & Iowa, and will move his

headquarters to Kankakee, Ill. J. J. Bernett, hitherto Assistant Superintendent of the Eastern Division, has been appointed Superintendent of the Eastern Division at Buffalo, N. Y., succeeding Mr. Worcester. H. M. Tompkins, of the General Superintendent's office, has been appointed Assistant Superintendent at Buffalo, succeeding Mr. Bernett. H. J. Merrick has been appointed Superintendent of Freight Transportation, with headquarters at Cleveland, Ohio, and the position hitherto held by Mr. Merrick, Car Accountant, has been abolished. (See New York Central.)

Long Island.—Donald Wilson has been appointed Superintendent of the Long Island express.

Louisville & Nashville.—W. P. Howard has been appointed Superintendent of the Owensboro and Nashville Division, with headquarters at Russellville, Ky.

Maryland, Delaware & Virginia (Pennsylvania).—The officers of this company are: President, S. M. Prevost; Vice-President, Willard Thomson; Secretary, James R. McClure, and Treasurer, Harlan G. Scott.

Minneapolis, St. Paul & Sault Ste. Marie.—Thomas E. Sands has been appointed Assistant General Freight Agent, with headquarters at Minneapolis.

Missouri & Louisiana.—John A. Sargent, Traffic Manager, has been appointed General Superintendent also, in charge of traffic and operating departments; D. S. Jones has been appointed Acting Superintendent of the Bevier District, with office at Excello, Mo.; H. P. Leveridge, Acting Superintendent of the Bonanza District, at Bonanza, Ark.; A. C. Somers, Superintendent of the Keith District, at Neame, La., and J. H. Morrison, Superintendent of the Carson District, at Carson, La.

Missouri Pacific.—J. T. Adams has been appointed General Tie Inspector of this company and the St. Louis, Iron Mountain & Southern, with headquarters in St. Louis.

New York Central & Hudson River.—Nathan Guilford, Traffic Manager, has been appointed Vice-President. He will have charge of traffic of the lines east of Buffalo, including the Boston & Albany Division. George F. Baker has been elected a Director, succeeding William Bliss, resigned. George Wagstaff, hitherto Assistant Master Mechanic at Collinwood, on the Lake Shore & Michigan Southern, has been appointed Supervisor of Boilers of that company, the New York Central, the Boston & Albany, the Lake Erie & Western, and the Indiana, Illinois & Iowa, with headquarters at Buffalo, N. Y.

Northern Central.—H. W. Kapp, Superintendent of the Baltimore Division, is now General Agent at Baltimore also, succeeding George C. Wilkins, retired.

Philadelphia & Reading.—William H. Keffer has been appointed Assistant Superintendent of the Reading and Lebanon Divisions, with headquarters at Reading, Pa.

Southern.—S. R. Kennedy, Superintendent of the St. Louis Division of the St. Louis-Louisville Lines, has resigned.

St. Louis, Brownsville & Mexico.—H. H. Kendall has been appointed Superintendent of Motive Power, with headquarters at Kingsville, Texas.

Susquehanna & New York.—S. T. Hayt, Jr., Superintendent, has been appointed Chief Engineer.

Terminal Railroad Association of St. Louis.—William Bawden has been appointed Master Mechanic, with headquarters at St. Louis, Mo., succeeding William Miller, resigned.

Union Pacific.—W. L. Park, hitherto Superintendent at Cheyenne, Wyo., has been appointed General Superintendent, succeeding J. M. Gruber.

W. A. Whitney, hitherto Assistant Superintendent, has been appointed to succeed Mr. Park at Cheyenne, Wyo.

LOCOMOTIVE BUILDING.

The La Crosse & Southeastern is reported to have ordered two 10-wheel locomotives.

The Directors of the Panama Railroad have authorized the purchase of four locomotives.

The Lake Superior & Ishpeming has ordered two consolidation locomotives from the Baldwin Works.

The Erie has ordered 50 consolidation (2-8-0) locomotives from the Rogers Works of the American Locomotive Co.

The Wabash-Pittsburg Terminal, as reported in our issue of January 20, has ordered six switching (0-6-0) locomotives from the Rogers Works of the American Locomotive Co., and six Atlantic type (4-4-2) locomotives from the Dunkirk works of the American Locomotive Co. The switching locomotives will have driving wheels 56 in. in diameter and cylinders 19 in. x 28 in. The Atlantic-type locomotives will have 77-in. driving wheels and 50-in. trailing wheels; cylinders, 20 in. x 28 in.; working steam pressure, 200 lbs., and tank capacity, 6,000 gallons.

The New York, New Haven & Hartford, as reported in our issue of February 3, has ordered 40 simple mogul (2-6-0) locomotives from the Schenectady Works of the American Locomotive Co., five simple 10-wheel (4-6-0) passenger locomotives from the Baldwin Works and five simple six-wheel (0-6-0) switching locomotives from the Rhode Island Works of the American Locomotive Co. The mogul locomotives will weigh 150,000 lbs., with 127,000 lbs. on drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 63 in.; radial stayed wagon-top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,111 sq. ft.; 308 tubes, 2 in. in diameter and 12 ft. 2 in. long; fire-box, 109 in. x 41 in.; grate area, 30 sq. ft.; tank capacity, 7,000 gallons; coal capacity, 12 tons. The 10-wheel locomotives will weigh 154,000 lbs., with 110,000 lbs. on drivers; cylinders, 21 in. x 26 in.; diameter of drivers, 72 in.; wagon-top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,666 sq. ft.; 318 tubes, 2 in. in diameter and 15 ft. 1 in. long; fire-box, 120⅜ in. x 41½ in.; grate area, 34 sq. ft.; tank capacity, 6,000 gallons. The switching locomotives will weigh 138,000 lbs.; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in.; straight-top radial stayed boiler with a working steam pressure of 200 lbs.; heating surface, 1,800 sq. ft.; 274 tubes, 2 in. in diameter and 11 ft. 6 in. long; fire-box, 102 in. x 39 in.; grate area, 28 sq. ft.; tank capacity, 4,500 gallons. The special equipment for all includes: Westinghouse-American air-brakes, Gollmar bell-ringers, sectional Magnesia boiler lagging, U. S. metallic piston and valve rod packings, Leach sanding devices and Bull's eye sight-feed lubricators.

CAR BUILDING.

The Illinois Central is reported to have ordered 1,000 box cars.

The Philadelphia & Reading has ordered four cafe cars from the Pullman Co.

The Central of New Jersey has ordered two café cars from the Pullman Co.

The La Crosse & Southeastern is reported to have ordered several 60-ft. passenger cars.

The Atchison, Topeka & Santa Fe has ordered 20 coaches and five chair cars from the Pullman Co.

The Pennsylvania Lines are reported to have ordered 10 composite wood and steel postal cars.

The Directors of the Panama Railroad have authorized the purchase of 100 box cars, 200 flat cars and four passenger coaches.

The British Columbia Electric Railway will, it is reported, build 21 passenger, baggage and work cars during the present year.

The Pere Marquette has ordered 20 coaches, five parlor cars and five baggage cars from the American Car & Foundry Co.

The St. Louis & San Francisco has ordered 51 additional box cars from the American Car & Foundry Co. to replace destroyed equipment.

The Fort Wayne & Springfield (Electric) is reported to have ordered three passenger cars and one express car from the Niles Car & Manufacturing Co., of Niles, Ohio.

The Cincinnati, Hamilton & Dayton, as reported in our issue of February 3, has ordered 10 coaches, six baggage, four parlor and three postal cars from Barney & Smith.

J. H. Heald Co., Louisville, Ky., has ordered 15 tank cars of 8,000 gallons capacity from the Bettendorf Axle Co. These cars will be used for hauling tannic acid, and will have Miner friction draft rigging and Bettendorf cast steel trucks.

The Boston & Maine, as reported in our issue of January 20, has ordered twenty 60-ft. passenger cars from the Pullman Co., for June delivery. The special equipment will include: Pullman bolsters and trucks, National brake-beams, Westinghouse automatic air-brakes, Gould couplers, Vinton curtain fixtures, Pintsch gas light, Miller platforms, Railway Steel-Spring Co.'s springs and Allen wheels.

The St. Louis, Troy & Eastern, as reported in our issue of January 20, has ordered 75 side-dump cars of 80,000 lbs. capacity from the American Car & Foundry Co. for March delivery. These cars are to weigh 39,000 lbs., and measure 38 ft. long, 9 ft. 2 in. wide and 9 ft. 6 in. high. The special equipment will include: American Steel Foundries' bolsters, Damascus brake-beams, Westinghouse air-brakes, More-Jones Brass & Metal Co.'s brasses and Janney couplers.

The Southern, as reported in our issue of February 3, has ordered 1,250 plain box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co., 1,250 box cars of 60,000 lbs. capacity from the Mt. Vernon Car Manufacturing Co., 2,000 hopper bottom coal cars of 100,000 lbs. capacity, and 500 box cars of 60,000 lbs. capacity from the American Car & Foundry Co. All box cars will be 36 ft. long, 9 ft. ¾ in. wide, over side sills, and 14 ft. high, over brake mast. The coal cars will be 33 ft. ½ in. long, over end sills; 10 ft. wide, over all; and 10 ft. 5 in. high, over brake mast, to be built of wood, with steel underframes. The special equipment for all will include: Southern Ry. standard axles, brake shoes and trucks; American Steel Foundries' body bolsters and Simplex truck bolsters, Monarch brake-beams, Westinghouse air-brakes, Ajax plastic bronze brasses, Climax couplers, Miner draft rigging, Harrison dust guards, McCord journal boxes and lids and Railway Steel-Spring Co.'s springs; for box cars, Jones door fastenings and doors and Winslow improved roofs.

BRIDGE BUILDING.

ALABAMA.—Bills were introduced in the U. S. Senate on Jan. 24 authorizing bridges over the Black Warrior river between Green and Marengo counties, and over the Alabama river between Clark and Monroe counties, Alabama.

BATTLE CREEK, MICH.—The City Council, according to reports, has decided to build two cement arches, one at Jefferson avenue and the other at Monroe street, to cost about $12,000.

BONNER'S FERRY, IDAHO.—A bridge is proposed over the Kootenai river to cost about $30,000.

BROWNSVILLE, TEX.—The St. Louis, Brownsville & Mexico is planning to build a steel bridge over the Rio Grande river at a cost of about $125,000.

CELINA, OHIO.—Bids are wanted by T. A. Weis, County Auditor, for the superstructure of a steel bridge 110 ft. long with 16-ft. roadway over the Wabash river in Washington township; also for a steel bridge 105 ft. with

16-ft. roadway over the same river on the township line between Washington and Recovery townships, in Mercer County.

Cincinnati, Ohio.—The Cincinnati, New Orleans & Texas Pacific will spend about $800,000 for steel bridges, to include one of 1,000 ft. over South Fork, one over Flushing creek 510 ft., a viaduct over the Cumberland river of 800 ft., and a viaduct at New river with a combined length of 1,300 ft.

Fort Francis, Ont.—A bridge is proposed over Rainy river between this place and Koochiching by a new road soon to be incorporated in Canada.

Idaho.—On Jan. 30 a bill was introduced in the U. S. Senate authorizing the Spokane International Ry. Co. to build bridges over Pend d'Oreille river and Kootenai river, in Kootenai County, Idaho.

Jefferson, Ohio.—The Board of County Commissioners has authorized an issue of $200,000 of bonds for the building of a bridge at Ashtabula Harbor to replace the structure condemned by the government.

Johnstown, Pa.—The Mayor has signed the ordinance providing for a loan of $30,000 to build the approaches for an overhead bridge to be built by the Pennsylvania Railroad Co. at Prospect.

Macon, Ga.—Plans, it is reported, are being made for putting up a concrete arch over the Southern & Macon and Dublin & Savannah tracks. The Central of Georgia, it is reported, will put up a bridge at Walnut street.

Michigan.—A bill has been introduced in the Lower House of Congress authorizing the Board of Supervisors of Berrien County, Mich., to build a bridge over the St. Joseph river, near its mouth, in Berrien County.

Mississippi.—On Jan. 31 bills were introduced in the Lower House of Congress authorizing Quitman County to build two bridges over Coldwater river and one over the Tallahatchie river.

The U. S. Senate on Feb. 1 passed the bill authorizing W. Denny & Co. to build a bridge over Dog river, in Mississippi.

A bill is before the U. S. Senate authorizing a bridge over the Tombigbee river, in Lowndes County, Mississippi.

Prince Albert, Sask.—A contract, it is reported, has been given to J. Gunn & Sons, of Winnipeg, Man., for building the new steel bridge of the Canadian Northern, to consist of nine spans of 150 ft. each and 100 ft. above low water, with concrete piers, over the South branch of the Saskatchewan river, about 15 miles above this place, to be completed by September 1.

Pueblo, Colo.—A contract has been given to the Marsh Bridge Co. at $28,000 for building the Commercial street bridge, which will be a concrete structure with two spans of 70 ft. each and 64 ft. wide. A contract has also been given to the Patterson Bridge Co. at $9,500 for the Chestnut street steel bridge, 135 ft. long and 32 ft. wide.

Shreveport, La.—The bill authorizing the City of Shreveport, La., to build a bridge over the Red river was passed by the House of Representatives on Jan. 24 and by the U. S. Senate on Jan. 27.

Smith's Ferry, Miss.—The U. S. Senate on Jan. 31 passed the bill authorizing the Pearl & Leaf Rivers R. R. Co. to build a bridge across the Pearl river at or near Smith's Ferry, the plans to be approved by the Secretary of War and the bridge to be used by all railroads desiring such use.

Waterloo, N. Y.—The Board of Supervisors have passed a resolution to petition the legislature for a new bridge over Seneca river to replace the free bridge now maintained by Seneca and Cayuga counties.

Other Structures.

Bangor, Me.—Plans are reported about ready for the new union passenger station to be built at this place at a cost of about $300,000.

Brunswick, Ga.—The Southern, the Atlantic Coast Line and the Atlantic & Birmingham, it is reported, will jointly put up a new passenger station at this place.

Colorado Springs, Colo.—The Chicago, Rock Island & Pacific, it is reported, has under consideration the question of building shops at this place.

Fort Dodge, Iowa.—The Minneapolis & St. Louis, local reports state, will build its division shops at this place.

Hartford, Conn.—The New York, New Haven & Hartford has given a contract to Horton & Hemenway, of Boston, Mass., for putting up two brick freight houses, one 50 x 800 ft. and the other 30 x 800 ft., at this place.

Jackson, Tenn.—The Nashville, Chattanooga & St. Louis, it is reported, is planning to put up a one-story brick station at this place.

Meridian, Miss.—Bids, it is reported, are about to be asked by the Meridian Terminal Association for putting up a new union passenger station.

Mexico, Mo.—At a recent meeting of officers of the Chicago & Alton and the Wabash it was agreed to build a union station at this place, to be located near Washington street.

Montreal, Que.—The Montreal Street Railway Co., reports say, has decided to spend $500,000 in improving its plant, including the building of three sub-power stations at different terminals, each to have a capacity of 1,000 h.p.

Olean, N. Y.—The Pennsylvania, it is reported, will spend about $300,000 in improving its shops.

Richmond, Va.—According to local reports, the Chesapeake & Ohio has decided to put up locomotive shops at a cost of $1,000,000 either at Richmond or at Huntington, W. Va.

Rochester, N. Y.—The Buffalo, Rochester & Pittsburg, it is reported, will put up a five-story office building to cost about $400,000 on Main street, west, near the present terminal station.

Shawneetown, Ill.—The Shawneetown & Rosiclare, recently incorporated, reports say, will put up a new roundhouse and machine shop. G. Hannon, Shawneetown, is Secretary.

Sheboygan, Wis.—The Chicago & North Western has plans ready for putting up a new passenger station to cost about $75,000. A new freight house 40 x 400 ft. will also be built.

Toledo, Ohio.—The plans of Architect T. C. Link for the new union station on Tenth street have been approved by the officers of the Wabash, and it is said that the main part of the building will be put up this year. The total length will be 480 ft. and average width 60 ft., and the train sheds will be 800 ft. long.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alton, Granite & St. Louis Traction.—This line, which runs from Alton, Ill., through Lakeview, Mitchell and Madison to East St. Louis and St. Louis, 20 miles, is now in operation into St. Louis, having made a traffic arrangement with the East St. Louis & Suburban whereby its cars will use the tracks of that company.

Atlantic & Birmingham.—An officer writes that this company, as reported in press despatches, plans to extend its line from Montezuma, Ga., to Birmingham, Ala., but that the route has not yet been decided upon.

This company is reported to be making extensive improvements on its line between Offerman, Ga., and Sessoms, which was formerly the Offerman & Western.

Canadian Northern.—The legislature of Manitoba has voted to guarantee $1,890,000 of Canadian Northern bonds, being $10,000 a mile for 189 miles of road. This guarantee is to provide for the construction of five branches as follows: From Carberry, Manitoba, to Brandon, and thence to the western boundary of Manitoba, 100 miles; from Winnipeg east across the Red river, 25 miles; a branch to Bird's Hill, seven miles; a branch from a point between Winnipeg and Oak Point across the Assiniboine river to connect with the St. Charles and Winnipeg line, seven miles, and a branch from Emerson to connect with the main line between Woodridge and Sprague, 15 miles. One million dollars of bonds additional was guaranteed for the purpose of acquiring terminals in Winnipeg.

Canadian Pacific.—Surveys are being made for extensions of the two branches from the Calgary & Edmonton branch at Lacomb and Witaskiwin. Each will be made about 100 miles long. Each is already being built for about 25 miles. (March 18, p. 222.)

A new line is proposed from Golden, B. C., to Jaffray, on the Crow's Nest Pass road, 180 miles.

It is announced that this company has bought the Esquimalt & Nanaimo Railway, which runs from Victoria, B. C., to Nanaimo, 76 miles, and it is said that the latter road will be extended from Nanaimo to Quatsino sound at the head of Vancouver Island. This would make possible the shortening of the sea route for mails to trans-Pacific ports nearly 24 hours.

Central Illinois Interurban.—This company has been incorporated in Illinois with its principal office at Mason City to build an electric line from Peoria south to Pekin, eight miles, thence south to Mason City, Lincoln and Springfield, 70 miles. John B. Abbott, Paul A. Emrows and Claude L. Stone, of Mason City, are incorporators.

Charleston & Summerville (Electric).—This company has been incorporated in South Carolina with Ogden Edwards, of Troy, Ohio, as President, and R. J. Smith, of Summerville, as Vice-President and General Manager, and a capital of $100,000, to build an electric road from Charleston northwest to Summerville, 24 miles, paralleling the Southern.

Chesapeake & Ohio.—The Big Sandy extension from Whitehouse, Ky., to Elkhorn City, 77 miles, is now in operation to Pikeville, the county seat of Pike County, 43 miles southwest from Whitehouse, and it is reported that the rest of the line will be completed early in the spring. (November 25, p. 168.)

Chicago & North Western.—An officer is quoted as saying that construction is under way on a cut-off from Manitowoc, Wis., north to Green Bay, 35 miles. (November 11, p. 153.)

Cincinnati, Hamilton & Dayton.—The Delphos division has been extended from Delphos, Ohio, northward to Mandale Junction, 12½ miles. (March 18, p. 222.)

Cleveland, Youngstown & Eastern.—This company, which has lately been formed, is planning to build from Moran, Ohio, 20 miles from Cleveland, on the Wheeling & Lake Erie, to Youngstown, 40 miles, and thence to a point near Newcastle, Pa., where it will connect with the Buffalo, Rochester & Pittsburg.

Cleveland, Wooster, Mount Vernon & Columbus (Electric).—This company, incorporated in Ohio in December, has issued a prospectus describing the route of the proposed road, which is from Wooster, Ohio, through Wayne, Holmes, Ashland, Richland, Knox, Licking and Franklin counties to Columbus, 105 miles, with a branch to Mansfield, Ohio, 12 miles. (December 9, p. 187.)

Dover & South Bound.—A charter has been granted in North Carolina by which this road, owned by the Goldsboro Lumber Co. and running from Dover to Richlands, 25 miles, may be extended to Swansboro, 30 miles. The company plans to build this extension with its own forces.

East St. Louis, Waterloo & Chester.—This company has been incorporated in Illinois with a capital stock of $25,000 to build

from East St. Louis through St. Clair, Monroe and Randolph counties to Waterloo and Chester, 50 miles. Thomas M. Chase and Tyron J. Woodward, of St. Louis, and Edward F. Schoening, of Columbia, Ill., are incorporators and on the first board of directors.

ENID, BEAVER, GUYMON & WESTERN.—A charter has been given this company, with a capital of $5,000,000, in Oklahoma Territory, to build a railroad from Enid through Garfield, Woods, Woodward and Beaver counties to Guymon, thence west to coal fields at Dorsey, N. Mex., a total of about 400 miles. R. B. Quinn and T. O. James, of Guymon; T. B. Bradford and George Healy, of Beaver City; W. I. Drummond, of Enid; J. E. George, of Liberal, Kan., and J. C. Gleicester, of New York, are among the incorporators.

FAIRMONT & CLARKSBURG TRACTION.—This company, which operates 21 miles of standard-gage trolley lines in Fairmont and Clarksburg, W. Va., has made arrangements to have $1,200,000 first-mortgage 5 per cent. bonds underwritten by Harvey Fisk & Sons, New York, the proceeds to be used in building a connecting line between Fairmont and Clarksburg, 15 miles. A. M. Young, William N. Barnum and Wilbur C. Fisk, all of New York, are on the board of directors.

FARMERSVILLE SOUTHERN.—This road is now in operation from Farmersville, La., 20 miles northeast to a junction with the Little Rock & Monroe at Litroe, La., just south of the Arkansas state line. Trains are being run into Felsenthal, Ark., over the L. R. & M. (See Construction Supplement.)

GRAND TRUNK.—It is reported that, as soon as the Canada Atlantic has been finally transferred to the Grand Trunk management, a branch will be built from Ottawa to Kingston, 100 miles. This would give the Grand Trunk a more direct line between Ottawa and Toronto than the present line via Coteau Junction.

GUELPH & GODERICH.—It is said that the grading of this road, which is to run from Guelph, Ont., west to Goderich, on Lake Huron, 80 miles, is practically finished, and that track laying will be begun early in the spring. The road, when completed, is to be operated by the Canadian Pacific.

HIGH POINT & WINSTON-SALEM.—This road is projected from Winston-Salem, N. C., southeast to High Point, 18 miles, paralleling the Southern, with an extension later of 25 miles. It is said that the construction of the first 18 miles will begin shortly.

IDAHO NORTHERN.—This road, which now runs from Nampa, Idaho, north to Emmett, 27 miles, will, it is reported, be extended from Emmett east to Horseshoe Bend, 20 miles.

INTERCOLONIAL.—On the extension from Campbellton, N. B., southwest to St. Leonards, on the St. John river, 100 miles, track is reported to have been laid 20 miles from Campbellton. It is said that work will be resumed on May 1 and the road completed to St. Leonards by the end of the year.

KANSAS CITY, MEXICO & ORIENT.—Contracts are reported to have been let for building the Kansas City Outer Belt & Electric Railway, which is the Kansas City terminal of the Kansas City, Mexico & Orient. The capital of the terminal company is $3,000,000 in bonds, $2,500,000 in preferred stock, and $2,500,000 in common stock. Negotiations for rights of way are said to have been going on for the past two years. The road will be eight miles long, seven miles of which will be within the city limits; and it will connect with every railroad entering Kansas City. It is leased for 99 years to the Kansas City, Mexico & Orient.

KANSAS CITY, NEVADA & SPRINGFIELD.—This company has been incorporated in Missouri to build from Nevada, Missouri, through Dade and Cedar counties to Springfield, 72 miles. John M. Meehan and Fred J. Smith, of Chicago, Ill., and Joseph French and Thomas Waddell, of Pierce City, Mo., are among the incorporators.

LAUREL RAILROAD.—This company has been incorporated in Johnson County, Tenn., with a capital of $10,000. H. A. Donnel, J. C. Butler and W. T. Smyth are incorporators.

LOUISIANA ROADS.—Mayor Forsythe and a committee of the City Council of Monroe, La., are reported to have made a contract with the Western Electric Co. for the construction and equipment of an electric road seven miles long to be operated by the city. The work is to be finished in six months.

MICHIGAN CENTRAL.—It is reported that the Allegan division, recently acquired by the lease of the Detroit, Toledo & Milwaukee, from Homer, Mich., to Allegan, 68 miles, will be extended to Grand Haven, 25 miles.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—It is reported that work will begin in the spring on an extension from Thief River Falls, Minn., west across the Red River Valley to Kenmare, N. Dak., on the present western main line of the road, 291 miles.

MISSOURI PACIFIC.—This company is reported to be making surveys for a branch from Joplin, Mo., southwest to Muskogee, Ind. T., 120 miles; also to be preparing to build the St. Louis cut-off from Lamar, Mo., northeasterly to a point on the St. Louis & Kansas City line.

NATIONAL OF MEXICO.—Press reports state that this company is making surveys from a point on the main line through the Rio Lerma Valley in the states of Guanajuato and Jalisco east to Guadalajara.

NEUCES VALLEY, RIO GRANDE & MEXICO.—Press reports state that the contract for grading 20 miles of this road, recently incorporated in Texas, has been let to Ward & Lee, and that work has been begun at a point near Artesia, Tex.

NEW ORLEANS GREAT NORTHERN.—This company was incorporated January 19 in Louisiana to take over the East Louisiana Railroad running from Pearl River, St. Tammany parish, west to Covington, 24 miles, with a branch to Mandeville, 12 miles, and to build and operate a line from Slidell, La., through St. Tammany and Washington parishes; also to make connections with the New Orleans & North Eastern, or to build independently, between Slidell and New Orleans. The company is capitalized at $1,150,000. F. H. Goodyear is President; C. J. James, Secretary, and N. G. Pearsoll, Manager.

NEW YORK & NEW JERSEY RAPID TRANSIT.—This company has been incorporated in New Jersey with a capital of $200,000 to build an elevated electric railroad from a point on the west shore of the Hudson river near the Weehawken ferry of the West Shore, through Hudson, Bergen and Passaic counties to Paterson, 13.6 miles.

NEW YORK, NEW HAVEN & HARTFORD.—An officer writes that construction work is now being carried on by this company as follows: Bridgeport four-track improvements, practically completed; Bridgeport passenger station, expected to be completed this summer; elimination of grade crossing in Fall River, practically completed; additional extension of second-track work on the Naugatuck division, in progress by J. J. O'Brien Contracting Co., Seymour, Conn., contractors; second-tracking of Highland division from Stormville to Towners, under way, C. W. Blakeslee & Sons, New Haven, Conn., and John W. Daly & Co., New Rochelle, N. Y., contractors; yard facilities, new engine house, coaling plant, etc., at Midway, Shore Line division, practically completed, Horton & Hemenway, contractors; two large brick freight houses under contract for erection in Hartford, Horton & Hemenway, contractors; new double-track steel bridge over Connecticut river at Warehouse Point, Hartford division, to be completed in the spring, Daly & Holbrook, contractors for substructures, and American Bridge Co., contractors for superstructures; new four-track steel bridges on the New York division in course of erection at Cos Cob, Westport, and Housatonic river, Daly & Holbrook, contractors for substructures, and Passaic Steel Co. and Pennsylvania Steel Co., contractors for superstructures; the Harlem River branch from Harlem river to New Rochelle, N. Y., at present double track, to be six tracked; not yet under contract.

NORFOLK & WESTERN.—The Big Sandy cut-off between Kenova, W. Va., and Naugatuck, 59 miles, has been put in operation. This is 25 miles shorter than the old line and saves about 50 minutes in the running time of through trains. (September 23, p. 103.)

OREGON SHORT LINE.—This company is reported to have let a contract for building the Twin Falls branch from Minidoka, Idaho, across the Snake river at Howell's ferry to Twin Falls City, 60 miles. The Utah Construction Co. has the contract for the first 20 miles, on which work has already been begun. (See Construction Supplement.)

PENNSYLVANIA SYSTEM.—A record of mileage for the year ending Dec. 31, 1904, has been issued by the company. This shows that the total main track on the lines east of Pittsburg and Erie is 5,190 miles, with 1,603 miles of second track, 538 miles of third track, 427 miles of fourth track and 3,640 miles of company's sidings, a total of 11,398 miles. There has been an increase during 1904 of 34 miles of first track, 105 miles of second, third and fourth tracks, and 164 miles of company's sidings, a total increase during the year of 303 miles. On the Pennsylvania Lines West of Pittsburg, the mileage is given as 2,861 miles of first track, 1,045 miles of second track, 104 miles of third track, 68 miles of fourth track, and 1,974 miles of company's sidings, a total mileage of 6,053. During the year 1904, there has been a decrease of 130 miles of first track, an increase of 217 miles of second, third and fourth tracks and of 21 miles of company's sidings, a total increase of 109 miles. The mileage of the consolidated Vandalia Lines is: First track, 797; second track, 19; sidings, 401; a total of 1,217 miles. During the year there has been an increase in first track of 138 miles, in second track of 19 miles, and in sidings of 55 miles; a total increase of 212 miles. The grand total of all lines, including those operated by and associated in interest with the Pennsylvania System, is 10,588 miles of first track, 2,831 miles of second track, 655 miles of third track, 501 miles of fourth track, and 6,613 miles of company's sidings, a total of 21,189 miles of track.

A "jump-over" is to be built at South Fork, 12 miles east of Johnstown, to enable eastbound passenger trains by an easy rise and fall to pass the junction with the Windber branch without crossing at grade the path of freight trains moving from the westbound main line to the branch; and according to a Pittsburg paper the contract for the work, amounting to $130,000, will soon be let. The Windber branch, leading to important coal mines, now has a movement of about 300 cars a day each way.

A contract has been given to Reilly & Webber, of Philadelphia, to make a large classification yard at Hollidaysburg, Pa. The contract provides for the grading and masonry work, comprising about 1,400,000 yds. of borrowed embankment, about 150,000 cu. yds. of excavation, and a change of the channel of a creek and of two undergrade bridges.

The contract for the masonry, street bridge abutments, foundations and retaining walls required for elevating this company's tracks in Camden, N. J., has been awarded to Sparks & Evans, of Philadelphia. (December 16, p. 198.)

PERE MARQUETTE.—It is reported that this company will make important betterments and improvements this year, among which are the following: On the Buffalo division, larger yards at St. Thomas, Sarnia, Blemheim and Walkerville, Ont.; 40 new passing tracks and a new slip and dock on the Canadian side of the Detroit river above Walkerville; on the Chicago division, a large freight house at Chicago.

PINE BLUFF & WESTERN.—An official of the St. Louis, Iron Mountain & Southern is reported to have said that the Pine Bluff &

Western would be opened for freight and passenger service during February. The road runs from Pine Bluff, Ark., northwest to Benton, 50 miles. It has for some time been in operation for freight from Pine Bluff west to Doylestown, 12 miles. When completed, this road will make possible a more direct line for the St. Louis, Iron Mountain & Southern from Pine Bluff to Hot Springs. (See Construction Supplement.)

PORTLAND, SANDY & MOUNT HOOD (ELECTRIC).—This company has been incorporated in Oregon to build an electric road from Portland east to Fairview and Troutdale, 15 miles, and thence eastward to the base of Mount Hood, 40 miles. Among the incorporators are Seneca Smith, Napoleon Davis and Guy G. Willis, of Portland.

RICHMOND & CHESAPEAKE BAY.—An officer writes that this company, which has just been incorporated in Virginia, and of which Frank J. Gould, of New York, is President, and C. P. E. Burgwyn, Richmond, Va., is Chief Engineer, will begin building shortly. Contracts will be let within four weeks. The line is to be operated by electricity from Richmond to Ashland, 17 miles, and by steam from Ashland via Ayletts to Tappahannock, with a branch from Ayletts to Gloucester Point. The only contract which has so far been let is to the Pennsylvania Steel Co. for 80-lb. rails. The work is easy, requiring no bridges, trestles or tunnels. The maximum grades will be 2 per cent. and the maximum curves 3 deg.

SAN PEDRO, LOS ANGELES & SALT LAKE.—An officer writes that the grading and track laying on this road between Daggett, Cal., and Caliente, Nev., 299 miles, are completed, the contractors for the last grading work being the Utah Construction Co., of Ogden, Utah, and Robert Sharon & Co., of Los Angeles, Cal. No date has been set for opening the road.

SOUTHERN.—The new branch of the Charlotte division from Hall's Ferry Junction, N. C., to Hall's Ferry, six miles, is now in operation.

SOUTH CAROLINA ROADS.—A bill has been introduced in the South Carolina Legislature to charter a railroad to be built from Charleston, through Charleston, Berkeley, Georgetown, Florence, Marion and Harry counties, to the North Carolina line, thence to Monroe, N. C.

ST. LOUIS, FREEBURG & FAYETTEVILLE.—This company has been incorporated in Illinois with a capital stock of $10,000 to build from Belleville southeast to Fayetteville, 15 miles. Fayetteville has no railroad at present. E. A. E. Ambs, of O'Fallon, St. Clair County, Ill.; Adolph A. Wolf and Peter Yaeger, of Freeburg, Ill., are incorporators and members of the first board of directors.

STANLEY, MERRILL & PHILIPS.—This road, which runs from Stanley, Wis., north to Hannibal, 24 miles, with a branch to Diamond Lake, has been extended from Hannibal to Jump River, eight miles.

TEXAS & GULF.—An officer confirms the report that this company is building south from Timpson. Twenty miles are now graded. The Grigsby Construction Co. are the contractors.

WEST VIRGINIA ROADS.—The Blue Creek Coal & Land Co., of which Charles H. Welles, C. S. Weston and H. W. Kingsbury, of Scranton, Pa., and J. W. Hollenback, of Wilkesbarre, are directors, is building 10 miles of road in West Virginia, and plans to extend the line 12 miles to the Elk river and down the Elk river to its junction with the Kanawha river at Charleston, 13 miles.

WESTERN ALLEGHENY.—Press reports state that this projected road from Queen Junction, on the Bessemer & Lake Erie, west to Newcastle, Pa., 28 miles, will shortly be begun.

WEST FORK & VALLEY RIVER.—This company has been incorporated in West Virginia to build from Clarksburg northeast to Grafton, 20 miles, paralleling the Baltimore & Ohio. Among the incorporators are Gordon B. Lake and C. H. Warmer, of Bridgeport, Harrison County, and R. G. Altizer, of Clarksburg.

WISCONSIN & MICHIGAN.—The Western division of this road has been completed from Everett, Mich., to Andan, Wis., 27 miles, and is in operation as far as Wharton, Wis., 22 miles. The Wisconsin & Michigan runs from Cundy, Mich., south to Peshtigo Harbor, Wis., 73 miles.

RAILROAD CORPORATION NEWS.

BOSTON & MAINE.—This company's statement for the three months ending December 31, shows as compared with the same period for 1903, an increase in gross earnings of $389,146, and in net income of $194,812; a decrease in interest, rentals and taxes of $32,359, and an increase in surplus of $227,170.

CHICAGO GREAT WESTERN.—Application has been made to the New York Stock Exchange to list $6,300,000 additional common stock.

DETROIT SOUTHERN.—The reorganization plan is announced for this road, which went into the hands of a receiver last July on defaulting payment on its 4 per cent. bonds. A new company is to be formed which is to issue $7,500,000 4 per cent. preferred stock and $5,000,000 second preferred, and an amount of common stock to be determined later. The new company will issue $4,253,000 4 per cent. general lien and divisional first-mortgage bonds, $3,866,000 of which will be used to replace the outstanding first-mortgage 50-year 4 per cent. gold bonds with 10 per cent. added in lieu of interest during the period of reorganization; also $22,500,000 4½ per cent. consolidated mortgage bonds. The present preferred stock will be replaced by new preferred of the same amount and will be assessed $10 a share, payment of which will entitle holders to consolidated bonds equal to the amount of the assessment. Holders of voting trust certificates of common stock will be assessed $5 a share, which will entitle them to the amount paid in consolidated bonds in exchange for their stock, and to an amount of second preferred stock of the new company equal in par value to 40 per cent. of their former holdings of common stock. All deposits must be made with the Colonial Trust Co. of New York before March 1. The reorganization will be underwritten by H. B. Hollins & Co. The $2,500,000 cash provided by the plan will be used to pay receivers' certificates, expenses of reorganization and for improvements.

DOMINION ATLANTIC.—Negotiations for the purchase by this company of the Midland Valley, running between Windsor and Truro, N. S., 58 miles, are reported to be complete, except for the approval of the Dominion Government.

FONDA, JOHNSTOWN & GLOVERSVILLE.—F. J. Lisman & Co., of New York, are offering at 96 and interest $500,000 first consolidated general refunding 4½ per cent. mortgage bonds of 1952 of this company, whose gross earnings for the fiscal year ending June 30, 1904, are reported as $673,022; net earnings, $315,611, and surplus, $50,761.

GRAND TRUNK.—This company has petitioned the Dominion Government for authority to acquire the capital stock of the Canada Atlantic, the Canada Atlantic Transit Co. and the Vermont & Province Line Railway.

ILLINOIS CENTRAL.—The December statement shows an increase of $1,838,221 in gross earnings, a decrease of $584,647 in operating expenses and taxes, and an increase of $2,422,868 in net earnings.

NEW ORLEANS RAILWAYS COMPANY.—The reorganization plan is announced. A new company will be formed which will authorize the following securities: $30,000,000 30-year 4½ per cent. gold bonds, $12,824,500 of which are to be reserved to retire underlying bonds on constituent properties, $13,356,750 to be issued to depositing bondholders, and $3,818,750 to be reserved for betterments and improvements; $10,000,000 non-cumulative 5 per cent. preferred stock, $4,452,250 of which will be issued in exchange for existing bonds, $1,758,480 for surrendered preferred stock, $2,758,890 for surrendered common stock, and $1,030,380 to be at the disposition of the reorganization committee for purposes of reorganization; $20,000,000 common stock, $8,792,400 of which is to go in exchange for present preferred stock, $9,656,115 to depositing common stockholders, and $1,551,485 to be at the disposition of the reorganization committee for purposes of reorganization. Bondholders who surrender their bonds under the plan, will for each $1,000 (par value) of bonds, receive cash to the amount of interest due January 1 on deposited bonds, $22.50, new bonds to the par value of $750 and new preferred stock to the par value of $250. Preferred stockholders are to be assessed $20 per share of old preferred stock, on surrender of which they will receive $20 in new preferred stock and $100 in new common stock. Common stockholders are to be assessed $10 per share of old common stock, on surrendering which they are to receive $10 in new preferred stock and $35 of new common stock. Securities must be deposited on or before February 28 with the New York Security & Trust Co.

PERE MARQUETTE.—On February 28, the stockholders will vote on the question of leasing the property to the Cincinnati, Hamilton & Dayton for 999 years. The lease will guarantee dividends at the rate of 5 per cent. per annum on the $16,000,000 common stock of the Pere Marquette, $12,854,000 of which is owned by the Cincinnati, Hamilton & Dayton.

PHILLIPS & RANGELEY.—Hon. Seth M. Carter, of Auburn, Me., has been appointed temporary receiver of this road, which runs from Phillips, Me., to Rangeley, 29 miles. The company has outstanding $150,000 first-mortgage 5 per cent. bonds and $50,000 second-mortgage bonds.

SEABOARD AIR LINE.—A traffic arrangement has been made with the St. Louis & San Francisco by which the S. A. L. runs freight trains over the tracks of the St. Louis & San Francisco from the present terminus of the Atlanta & Birmingham Air Line in Birmingham, via Pratt and Ensley, to Bessemer City.

SOUTHERN PACIFIC.—The refunding bond issue is announced to be $160,000,000 four per cent. bonds, to mature in 1955, guaranteed by the Southern Pacific Co. Seventy-five million dollars of this issue has been underwritten and was sold within less than a day by Speyer & Co. and Kuhn, Loeb & Co. About $42,000,000 of the proceeds from this amount will be used by the Southern Pacific to refund bonds maturing during the current year. Details of the purposes for which the remaining $33,000,000 of bonds will be used will be included in a mortgage, the terms of which will shortly be announced. The $85,000,000 unsold will be reserved to take up the remaining underlying bonds, upon whose maturity the new bond issue will be a first lien upon substantially all the lines of the Southern Pacific Railroad in California, Arizona and New Mexico.

ST. LOUIS & SAN FRANCISCO.—Farson, Leach & Co., New York, are offering $2,000,000 of St. Louis & San Francisco seven-year 4½ per cent. notes at 98 and interest. They are part of the $4,500,000 issued to refund the Arkansas Valley & Western notes and for other purposes.

WESTERN MARYLAND.—A further agreement has been made with the Baltimore & Ohio whereby the Western Maryland is given trackage rights between Cherry Run, W. Va., and Cumberland, Md., over the Baltimore & Ohio, pending the completion of its own line now building between these points. This permits the immediate shipment of coal and coke from the Western Maryland's subsidiary coal company to its tidewater terminals at Port Covington.